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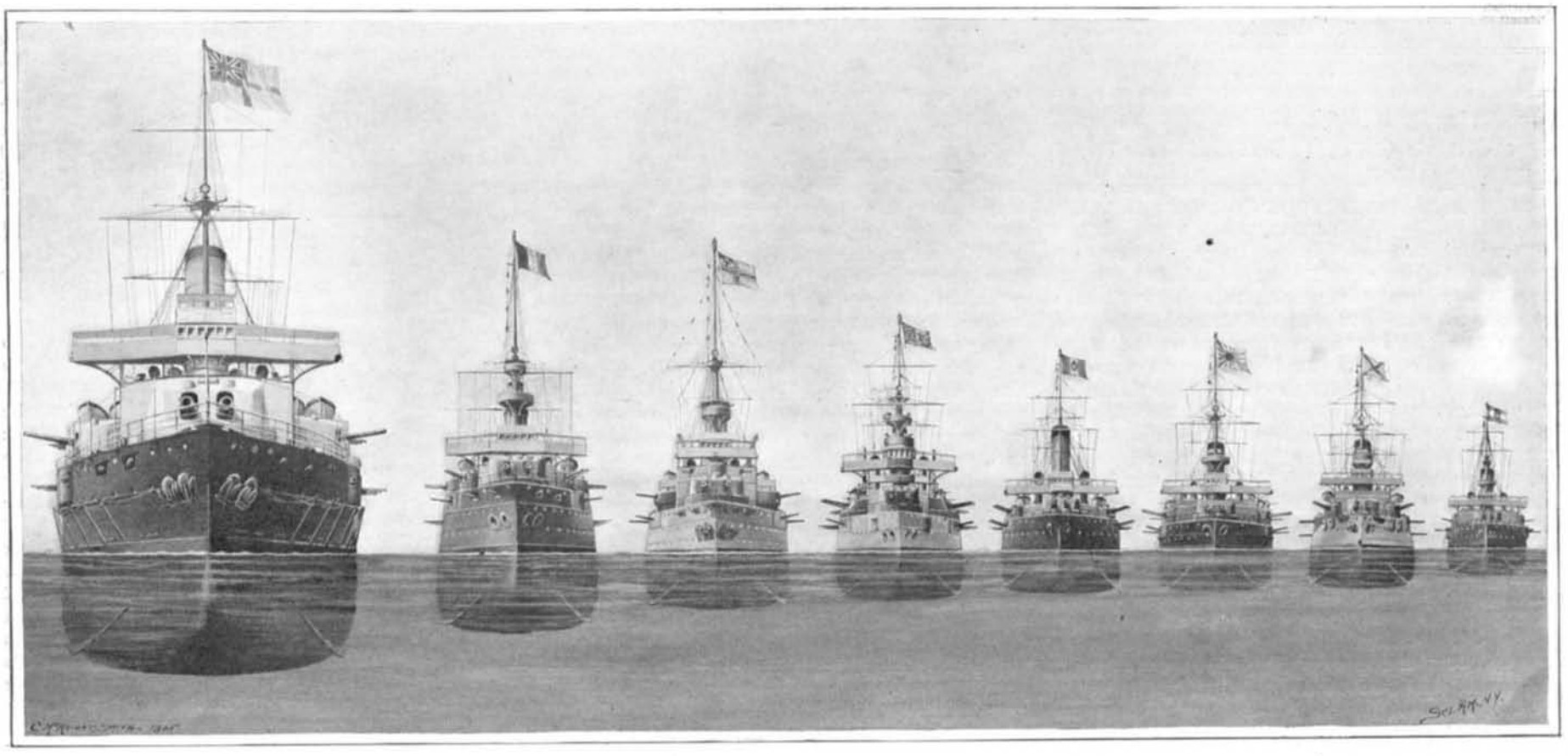
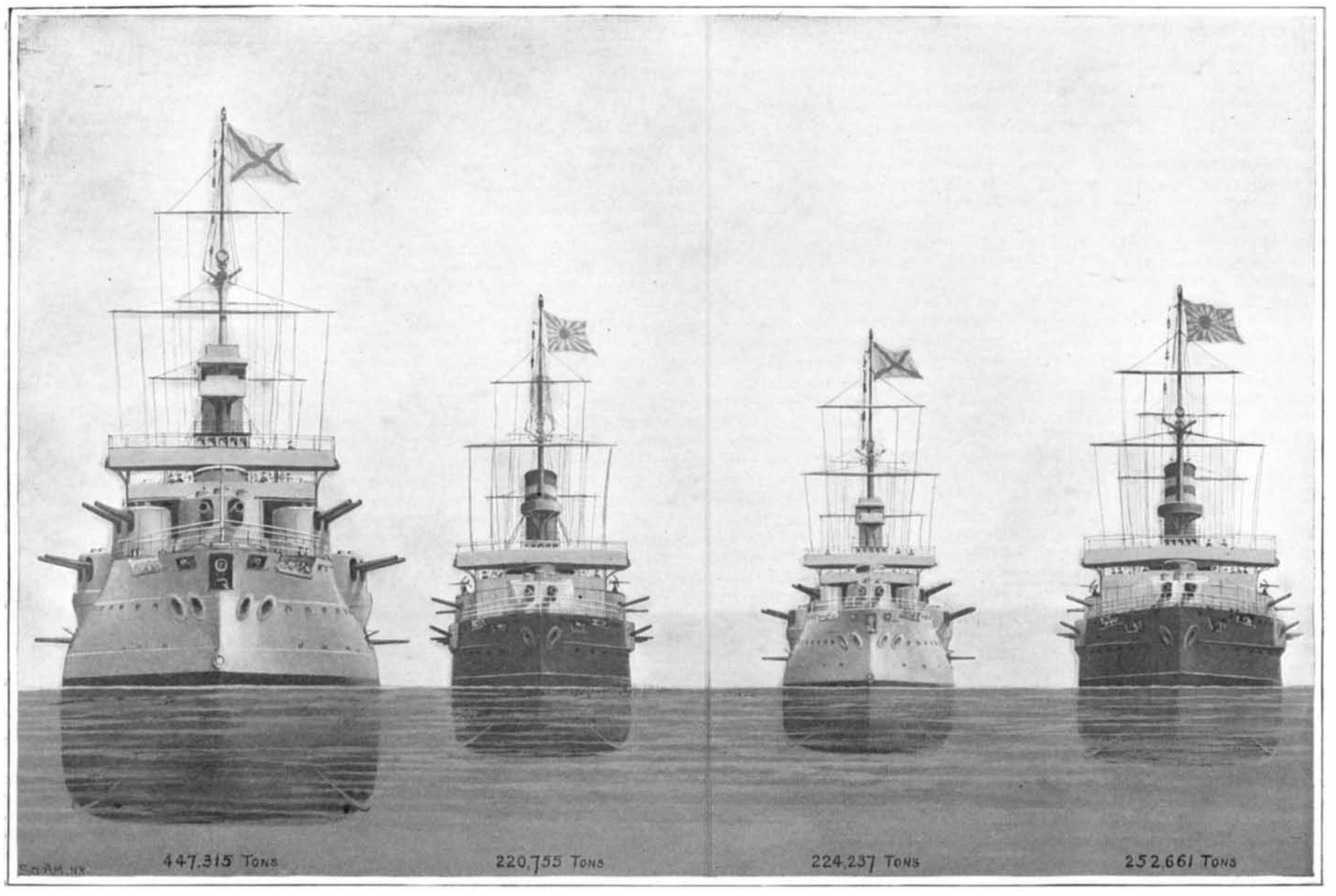
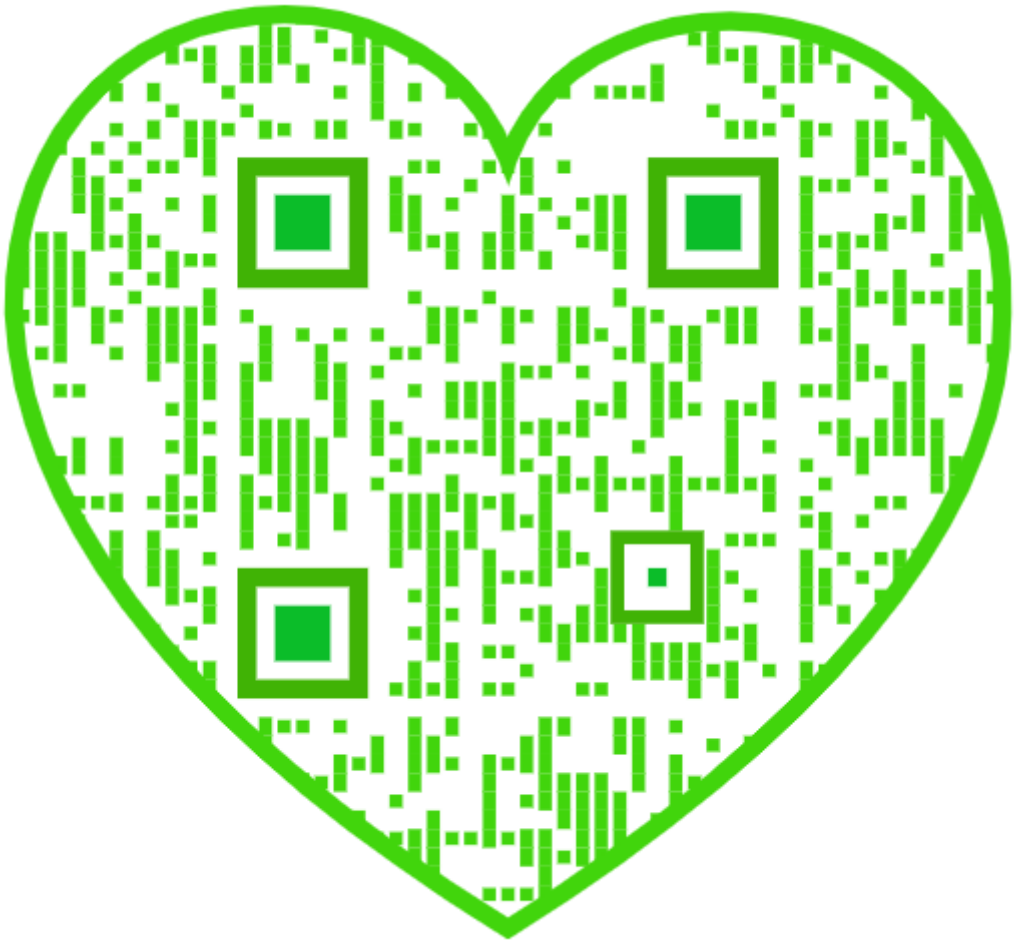


Comparative Strength of the World's Navies in Completed Ships.



Comparative Size of the Russian and Japanese Navies in 1904 and To-Day.

COMPARATIVE STRENGTH OF THE NAVAL POWERS.—[See page 26.]



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NEW YORK, SATURDAY, JULY 8, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE UNITED STATES AND THE COMMAND OF THE PACIFIC.

There are two sea fights of modern history that have served to thrust the United States, in spite of its traditional and constitutional desire to stay within its own borders and on its own seaboard, right into the very center of that struggle for commercial and political control of the far East which promises to furnish the greatest drama of the kind in the history of the world. Of these decisive battles, the first occurred on the first of May, 1898, when Admiral Dewey destroyed the Spanish fleet at Manila; the second, on August 10, 1904, when Admiral Togo drove the Russian fleet back into Port Arthur, and, as the event has shown, destroyed Russia's last hope of maintaining her naval supremacy in the far East. As the ultimate result of the battle of Manila, the United States finds its outposts advanced some five thousand miles to the westward, and established in a scattered group of islands which in the event of hostilities would become the inevitable point of attack by any hostile naval power. From the year 1898 to the beginning of 1904 the problem of the defense of its far Eastern possessions was no greater for the United States than for any of the European powers that possessed interests in the Pacific Ocean; in fact, the distance of the Philippines from the United States is considerably less than the distance of Indo-China, Kiao-Chow, or Hong Kong from France, Germany or England; and during that period the Japanese navy was not looked upon as a sufficiently formidable competitor to exercise a controlling effect upon our naval policy in the Pacific. The battle of August 10 and the sweeping victory in the Sea of Japan, however, have changed all that. Not only has the absolute annihilation of Russia's Pacific fleet relieved the Japanese government of the repressive influence which was necessarily exerted by the presence at her doors of an ever-threatening hostile fleet; but the positive genius for modern naval warfare displayed throughout all ranks of the Japanese navy has increased its prestige and enhanced its fighting value enormously. Should the war bring no material increase in the tonnage of the Japanese navy, the latter will constitute, because of its propinquity to the Philippines, the most important element to be considered in the future defense of those islands. But as a matter of fact, the war will leave the Japanese navy far stronger than it was at the outset. Captures and new construction during the war have already more than offset the Japanese losses, and if the ships interned in neutral ports are handed over to Japan as part of the indemnity, she will possess, in completed ships, a total tonnage that is only about 16,000 tons less than the completed tonnage of the United States navy on November 1 of last year. That a large portion of the indemnity, should one be paid, will be appropriated to the construction of battleships and cruisers of the very latest type, is a foregone conclusion. Most of the new ships will be built in British and Japanese yards, and the former, at least, will be completed with dispatch.

In the presence of these facts, our Board of Naval Strategy must already have realized that, unless Congress is willing to continue a liberal policy in the matter of naval appropriations, we are within measurable distance of the time when the Japanese will have, in the Pacific, a navy that is enormously superior to any possible force which we could concentrate in those waters.

THE CANAL FROM PITTSBURG TO THE LAKES.

The magnitude of the iron and steel interests in the Pittsburg district, and the determination of the United States Steel Corporation to introduce every possible economy into the manufacture of steel in that busy center, is again brought before the public notice by the formation of a company for the construction and operation of a canal for the carriage of iron ore direct from Lake Superior to Pittsburg. The cross section of the canal is to be sufficient for the accommodation of vessels of a displacement of 2,000 tons. The preliminary surveys, which are now under way, indicate that the length of the canal on the location which will probably be determined upon, will be about 110 miles. The indications are that there will be no engineering problems encountered that are novel or untried.

The topography of the proposed route of the canal between the junction of the Allegheny and Monongahela and the Lakes, and the desirability of a water route between these points, directed attention to the problem as far back as Revolutionary times. Washington, himself an engineer, was alive to its importance and practicability, and the scheme for its construction was regarded by him favorably. Fifty years later, surveys were made by the Federal authorities and also by the State of Pennsylvania, and upon the basis of these a canal of modest dimensions, whose navigable depth was between four and five feet, was constructed, and gave useful service for a period of forty years.

Although the original canal proved remunerative as a carrier of common merchandise, the larger waterway that is now projected, while it will, of course, be available for general merchandise, is to be built for the special purpose of enabling the ore-carrying steamers which now have to stop at Conneaut, or other Lake ports, and transfer their cargoes to the railroad, to make the whole journey from Lake Superior to the Pittsburg blast furnaces direct. The saving by this all-water route will be two-fold. In the first place, the considerable cost of transshipment of the cargo from the hold of the vessel to the ore bins, or to the cars, will be saved; and in the second place, there will be a further considerable saving, due to the fact that the ore can be carried more cheaply by water than by rail. The construction of this canal would insure the permanent pre-eminence of the Pittsburg district as the leading center of the steel industry, by placing it in all respects on an even footing with the blast furnaces that are located on the Lakes; for the advantage of shorter haul of the raw materials enjoyed by the furnaces at Chicago and Cleveland would be offset by the proximity of the Pittsburg furnaces to the magnificent and abundant supplies of coke from the neighboring Connellsville district.

SAFETY ON THE SEA.

In the presence of the fearful loss of life in accidents on our railroads, it is with relief that we contemplate the ever-increasing safety of travel by sea. Year after year passes by, without any of the important passenger steamers that cross the Atlantic, or other oceans on which passenger travel is heavy, meeting with an accident that causes risk of life or limb to the passengers. This fact is the more remarkable when we remember that ocean travel has increased by leaps and bounds during the past decade; that not only are there more steamers following the lanes of travel, but that they are running at much higher speed. The mail steamers come and go with a regularity approaching that of the best railroad schedule, and it takes the very fiercest of Atlantic midwinter gales to interfere seriously with this punctuality. In seeking for the causes of this remarkable immunity from accidents, we have to look not at the natural, but at the human elements of the situation. Seas are as broad and tempestuous as ever; fogs as impenetrable as those that baffled the early navigators still brood over the surface of the deep; the sunken reef; the shifting sandbar; the variable current; and many another natural cause of marine disasters, still beset the path of the navigator. Therefore, it is to the triumphs of invention and the perfecting of human control and management that we must look for an explanation of the all but absolute security of steamship travel to-day. The secret of this security is to be found both in the structure of the ship itself, and in the marvelously ingenious devices which science and invention have placed at the service of the navigator to guide him in the more perilous phases of his duty. Without enumerating those elements of watertight subdivision, vast size, and better control, in the ship itself, or the wonderfully sensitive and refined apparatus at the command of the modern navigator, we need but refer to two of the very latest safeguards, in the form of wireless telegraphy and submarine signaling, to show that the present immunity from accidents is traceable to clearly recognized human causes.

The last-named invention is a close rival to the wireless telegraph in the great increase that it has made in the safety of travel on the sea. Testimony to its efficiency was recently given by an officer of the "Kaiser Wilhelm der Grosse," upon which the new equipment is carried. We have so frequently described the device in the columns of the SCIENTIFIC AMERICAN, that it is sufficient to say that at the lighthouse or lightship there is a bell upon which signals are sounded, and that upon the ship is carried a receiving device in the form of an iron tank attached to the inside of the plating below the waterline, from which wires are led to telephones in the chart room or on the bridge. One receiver is placed on each side of the ship, with separate wires from each, and by the use of telephones the officer is able to hear a bell that is being struck at a point many miles distant from the ship, and determine its direction. The officer of the "Kaiser Wilhelm der Grosse" states that on the last trip over, when the ship was four miles distant from the mouth of the River Weser, he plainly made out the signals conveyed from the lightship there. Furthermore, as the vessel neared Nantucket, and when she was about four miles distant from the lightship, he heard through the telephone the signal "66." This consists of six strokes of the bell, a pause and then six more strokes of the bell, which is the Nantucket lightship code signal. At about the same distance from Fire Island light and from Sandy Hook lightship, the respective signals were distinctly audible. The value of this device in preventing collision between approaching ships is evident; for it has this advantage over the foghorn, that the direction of the approaching vessel, whether from port or starboard, is determined at once by the fact that the sounds are audible to the port or starboard telephone.

NEW ELECTRIC RAILROADS.

Among the new electric railroads on the Continent which have been constructed or are now building may be mentioned the new electric line running between Amsterdam and Haarlem. This is one of the last electric roads to be installed, as it was only finished last October. Since then it has been running very successfully. The length of the electric railroad is some sixteen miles. It passes along the main roads for the most part. Current is brought into the motor cars by a trolley of the arc or bow form. The overhead wire for the trolley is carried upon cross wires which are stretched across the track between iron poles. Inside the city limits the track follows the general lines of tramway construction and employs a grooved rail, but between the two cities the railroad form of track is used, with Vignole rails weighing 70 pounds per yard. At last accounts there were 35 cars in use upon the line. The chassis of these cars is mounted on four axles. Two electric motors are used for each car. These motors have a capacity of 50 or 60 horse-power at the maximum output. At the top speed, the cars run at 40 miles an hour. To supply current for the electric line, the railroad company has built a large dynamo station at a point near the middle of the line. The station is equipped with a battery of six Lancashire boilers having 90 square yards heating surface each. The boilers are provided with superheating apparatus. There are three main groups of direct-coupled generating apparatus in the dynamo hall. Each of these groups is similar and consists of a Bellis three-cylinder engine of 460 horse-power, running at 370 revolutions per minute, connected on the same shaft with a Westinghouse compound dynamo of the railway type, furnishing 575 volts direct current for the trolley circuit. Among the roads which are soon to be built is the line from Cologne to Düsseldorf. Two of the leading German electrical firms, the Allgemeine Gesellschaft and the Siemen-Schuckert Company, are to furnish the outfit for this road, supposing that the authorities allow them the concession, which is very probable. These two cities are connected at present by the Cologne-Berlin railroad. The new electric line is to form an extension of the trolley roads which are now running in each of the cities, and the two systems will be joined to each other by the interurban line. In this way there will be no need of special stations, but passengers can take the cars anywhere in the city. It is proposed to run cars on the line between the two cities every ten minutes. In 1910 it is estimated that the combined population of Cologne and Düsseldorf will reach 770,000, according to the present rate of increase, and a heavy traffic is expected on the new road. As to the expense of installing the interurban line, this has been figured at $5,000,000. According to the most recent reports it appears that a syndicate has been formed at Brussels for constructing a direct line from that city to Berlin. It is to use electric locomotives of high power, and the trains are to cover the distance between the two cities in seven hours. This will require a speed which exceeds 90 miles an hour, and in order to run at such a high speed, the railroad must be built as nearly as possible in a straight line.

The forms of timber trusses of different kinds, arches and combinations of two or more systems, have been very numerous. A marked step toward bridge designs of the modern truss form was the lattice bridge patented by Towne in 1820, which became the prototype of the early iron lattice bridge. The next important step in the development of wooden bridges was made in 1840, when Howe patented his truss, which became very popular and the standard for wooden railroad bridges. In 1844, the Pratt truss was patented, which afterward became the favored type for iron bridges. Many other types of trusses were invented, which have since been discarded.

ELECTRIC RAILWAY DEVELOPMENTS.

BY PROF. HORACE T. EDDY.

In view of the recent great developments and extensions of the electric railway, a general review may be of interest. When, as to-day, the reports of the proposed electrification of steam roads become so common as to cause little wonder, well may the question be asked, "What will it all lead to?" Still another question insists on coming to the surface, viz.: "Is the A. C. motor likely to revolutionize electric traction?" Although the answers to these questions depend largely upon future developments and therefore cannot be exactly predicted, some conclusions can with certainty be drawn. The trend of developments is of special value in attempting to outline what may be expected in the future.

During the last ten years the electric railway business has developed far more rapidly than any other of comparable size. This is particularly true abroad, where over 90 per cent of the present roads have come into existence through displacement of horse or steam, or by new investment, during that period. In no other country than the United States has there been great development along the line of interurban railways, which require heavy equipment, operating at moderately high speeds.

The engineers of this country have so perfected and standardized the direct current equipment for this class of service, that there is little improvement to be expected in that line. The operating characteristics of suburban and interurban systems are not usually very dissimilar from those of ordinary city lines. Although the load is not distributed so evenly over these systems as in city railways, the concentration due to higher speed and heavier equipment is not so serious as to require any fundamental change in the character of the system. The economical limit of speed and weight of train units for this kind of system depends chiefly upon the one condition of distribution of the load. The gigantic undertaking of the New York Central Railroad to handle all trains within 35 miles of New York city by electricity is so far the greatest proposed development along this line. There has been much criticism and discussion as to whether some other system would not better fulfill the requirements of the case. It is not difficult to show that the choice made was the best one, because it rested on the fundamental consideration that no system of traction has yet been devised which can in any way compete with the standard D. C. system, on roads where the load has fairly even distribution.

Although a single New York Central passenger train will require upward of 2,500 K. W. at times, this energy is such a small proportion of the total average load on a section fed from one power house, that the system can still be classed with those having a distributed load; the sole difference being that this one is on a scale of magnitude almost undreamed of a half dozen years ago. There were many problems to be solved in this undertaking and the bold way in which the choice of the type of motor for the locomotive was worked out is an indication of the technical ability of the engineers employed. The new motors are unique in that the armatures are mounted on the car axles. The absence of gear losses makes their operating efficiency very high. Because of the simplicity of construction and consequent small depreciation made possible by their design, it is the best motor so far designed for use in high-speed D. C. locomotives.

These new electric locomotives are designed to haul a 450-ton train at a maximum speed of from 60 to 65 miles per hour. At present the New York Central's heaviest passenger trains entering New York city weigh about 875 tons, and more than one locomotive will be required to haul them at such speed.

It is seen upon analyzing the New York Central's proposed electrification, that the operating characteristics are not the ordinary ones of steam trunk lines where heavy fast trains are run at infrequent intervals. There has in fact been nothing of importance done or even attempted along this latter class of service, which will be called heavy concentrated loading.

The nearest approach to such service is found in some of the heavy interurban lines; the limit of speed and distance is soon reached in these lines using D. C., because of the great cost of delivering the current to the train. The third rail has extended this limit but slightly.

Five or six miles is the limiting distance of economical distribution at the standard voltage of 600. If a single station or sub-station can distribute to a distance of five miles in each direction, then stations must be built every ten miles along a line of railway. A concrete example will show how unsuited such an arrangement would be for heavy concentrated loading. Suppose a railway line 100 miles had only one train in operation. If this train required 1,000 K. W., then the power house capacity would be 1,000 K. W. and each sub-station 1,000. There would have to be eight sub-stations or a total sub-station capacity of 8,000 K. W. The conducting system would also have to be sufficient at every part to deliver 1,000 K. W. economically to the train. The investment in transforming or generating equipment must be all out of proportion to the power used in such service. The case assumed is an exaggerated one for the purpose of illustration. The principle involved is really the root of the difficulty which must be overcome before ordinary steam traffic can be replaced by electric.

In order to overcome the difficulties, either the characteristic of the traffic must change from large train units at infrequent intervals, to distributed service, or the distance to which energy can be efficiently delivered to moving trains from one station must be increased. The former solution may in some cases play an important part, but the general solution of the problem rests with the latter method, in which the first necessary requirement is a high voltage of distribution to the train. If a much higher voltage than 600 is used, the third rail is entirely unsuited. It would be too dangerous to life and can not be well enough insulated for good operating conditions. A higher distributing voltage, then, necessitates the use of a trolley wire overhead. Satisfactory trolley collecting devices have already been developed but much remains to be done in the way of making high trolley voltages safe. In D. C. use the trolley voltage is limited by the motors. Much higher voltages than 600 can not be successfully commutated on one commutator.

If two motors could be made to operate well in series and in that way double the trolley voltage, it would be possible to efficiently distribute the current to a distance of about 25 miles. In spite of the reasonableness of this scheme some engineers dismiss D. C. systems from serious consideration in connection with concentrated loading.

Several systems have been devised for using A. C. distribution at high trolley voltages. Some of these use D. C. and others A. C. motors. There is no voltage limitation in these systems, theoretically, which necessitates placing the power stations closer together than other conditions of economy require and the transforming equipment need be no greater than the motor capacity in use. All stations would be power houses and the great length of line fed from each station would make its load sufficiently constant for economical operation.

The most important of the proposed systems can be classified under three heads:

1st. Those using rotary apparatus on the locomotive for converting A. C. to direct, for the D. C. motors. The Ward-Leonard system is a notable example of this arrangement. It is particularly adapted for moving heavy trains.

2d. Those operating by means of induction motors requiring polyphase distribution to the train. The tests at Zossen, Germany, were made with this system and although speeds up to 135 miles per hour were easily reached, this system has proven itself absolutely unsuited for general railway service.

3d. Those using a single-phase A. C. motor with the speed characteristics of a series D. C. motor.

The induction motor is inherently a constant-speed motor and is therefore not suited for traction. On the Continent there are several roads using polyphase induction motors, but the railway engineers of this country have been conservative and unwilling to introduce such a system which could not compete with standard D. C. systems. Their stand against the polyphase motor is justified by financial considerations and has not been due to any lack of progressiveness.

It is only within the last year that a successful single-phase A. C. motor has been developed and as yet it has not had a thorough test under the severe conditions of actual service. In order to have an efficiency and lightness at all comparable to the D. C. series motor its air gap must be made extremely small. Whether the air gap can be made small enough for the motor to have a good efficiency and at the same time stand up under usage, time alone can determine.

The fact that the motor can operate equally well on D. C. will doubtless hasten its development, and even though this motor does not succeed in solving the problem of concentrated service on heavy passenger and freight lines, it seems well suited to the lighter concentrated service of long interurban lines. Unfortunately the motor has a commutator, which is, if anything, more troublesome than that of a D. C. motor. However, the voltage impressed on the motor need not depend on the trolley voltage but can be transformed so as to give the best conditions for commutation.

A comparison of A. C. series with the D. C. series motor equipment, does not show all the advantages to be in favor of the former. Nor is it probable that the A. C. system will ever displace the D. C. system in certain kinds of service. The car equipment for A. C. costs more than for D. C.; is heavier and of slightly lower efficiency except during acceleration. These disadvantages must be more than offset by the smaller amount of trolley copper and elimination of rotary sub-stations, made possible by the A. C. motor in order for it to successfully replace its D. C. rival. It is likely that each system will have a place of its own.

The foremost engineers of the country are so contradictory in their opinions of the present status of the problem of A. C. versus D. C. and their predictions of the future development are likewise so diverse that there are evidently many points which cannot be definitely settled until further development takes place. The probability of the series A. C. motor revolutionizing electric traction is very remote.

On a system of very dense traffic heavy trains might not introduce a seriously great load on the station feeding even a comparatively short section, and it may be that some road like the New York Central will attempt the electrification of a considerable portion of their system along the same lines as their terminal plans now under way, i. e., using D. C. at standard voltage. If any line should make such a change it might be that competing lines would find their passenger traffic so reduced that in order to retain it they would be obliged to also electrify their passenger traffic. There is no doubt that the traveling public desires transportation by electric traction and that the change to electric by any steam road running fast long-distance passenger trains, will bring about a great increase in the amount of business. Probably in no system will the outlay of capital for electric operation be as small as for steam operation, neither will the decrease of operating expenses under electric system pay for the interest on the larger invested capital, but the greater traffic and consequent greater earning capacity of the road *will* more than pay for the increase of outlay. Electrification means more than a mere change of equipment; it involves an improvement in traffic conditions which is bound to favor the electric system. The preference of the public for electric traction is shown in almost every case where an interurban line parallels a steam line. Practically all of the local traffic is taken from the steam line even though the schedule made by the interurban is slower. This competition has been felt so keenly by the managers of steam roads that they have attempted to prevent the building of electric roads paralleling their lines.

There have been a few cases where the steam railway has operated an electric road acquired because of competition as an auxiliary to their steam system. This is a legitimate undertaking and has the advantage of educating the steam railway managers to the advantages of electric traction. Some such educational process may be responsible for the change of attitude of steam railway engineers and managers which has occurred during the last year or two. In place of the hostility and skepticism of the couple of years ago regarding any encroachment of electric traction upon steam roads the present attitude is one of expectancy—of waiting for such developments as will permit of the use of electric locomotives in place of steam.

As the cost of fuel will necessarily increase with time, there will be an increasing necessity for changing from steam to electricity because of the better fuel economy of the stationary engine over the steam locomotive. The saving in cost is especially great when water power is available along the route.

In the rapid development of scattered interurban lines there has been little effort until recently to develop through traffic. In this respect the conditions are like the early days of steam railways when it was necessary to change cars fifty times between New York and Buffalo, when each individual road in trying to work out its own salvation lost sight of the necessity of working together for the common good of all. Fortunately for trolley lines the voltages used on D. C. systems are nearly all standard and there is no difficulty in consolidating systems and so developing long-distance service.

A general survey of the situation in this country indicates that the further developments in electric railways will occur as a gradual extension into the realm of steam railroads, rather than any sudden displacement of steam equipment. It is hardly possible that in a period of six or eight years the electric locomotive will become a serious menace to the steam locomotive, although it is the firm belief of the writer that eventually all steam traction will be superseded by electric.

The greatest problems of American agriculture are not the narrower technical ones, but the relations of the industry to economic and social life in general. Agriculture has not as yet been able to call to its aid in any marked degree those forces and tendencies which have culminated and been of such economic value in the general business world, in the great productive and distributive aggregations. The complete solution of the economic ills of American agriculture may not be in co-operation, and yet in both the productive and distributive phases this is perhaps the most apparent remedy. Co-operation in distribution has made a beginning, but co-operation in production is still almost unknown.

FEATHERED FLYING MACHINES.

BY W. E. IRISH.

IF the importance of the aeroplane as a factor in aerial navigation there can be no doubt. The aeroplane is vastly heavier than the air it displaces, but as weight is essential to all natural flying machines it is only reasonable to suppose weight will be necessary in any successful flying contrivance. Based on these simple lines, small and large gliding machines have been constructed and experimented with varying from 12 square inches of surface to 500 square feet and capable of carrying 1 ounce to 1,000 pounds.

Aerial navigation is the act of sailing from place to place through the air by means of mechanical contrivances, and in its study, as in the study of all other sciences, there must be a beginning and season of experiment, and the more simple, effective, and inexpensive the experimental apparatus, the better. I made my first models from wing feathers arranged to represent birds in their most simple form of flight, gliding and soaring, and I gleaned from experimenting with these, more practical information in one hour than otherwise obtainable by months of close study.

The chief difficulties to be overcome before the successful flight of man can be attained are leaving the earth and safely alighting where desired, and maintaining equilibrium.

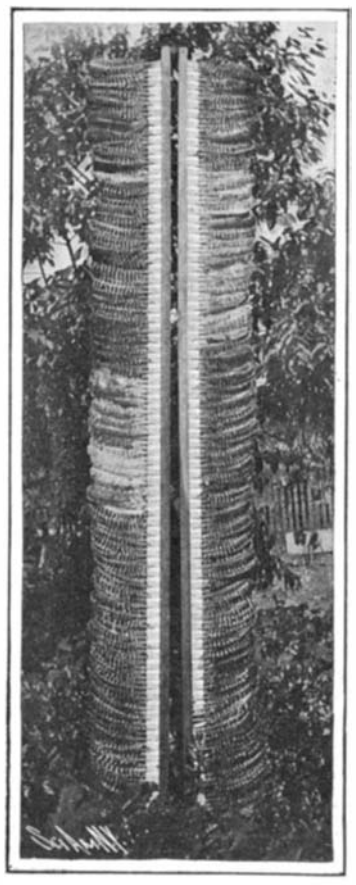
Feathers taken from the wings of birds have the ideal curvature for artificial supporting surfaces, whereas the tail feathers can be more advantageously employed in the rudder; and the germ of the truth that practical mechanical flying machines are possible may be found in a pair of wing feathers, which when properly arranged will not only glide long distances with, against, or across the wind, but actually soar into a wind having a slight upward trend. In their gliding descent with the wind their speed is accelerated until they often outrace the wind itself. It has been truly said, pluck the feathers from a bird, and it can no more fly than a man; properly arrange feathers on a man, and he should soar like a bird.

A very simple and fairly stable model can be made with a perfect pair of wing feathers, right and left, joined by cementing one quill within the other, which if let fall upside down will glide a far greater distance than any like model made of paper or other material. By burning a hole fore and aft, and passing a wire through the guides where they balance, and looping the wire ends, a very interesting model is formed, which when hooked on a short line, and whirled uniformly above and around the head by means of a rod, or held against a strong wind, will perform flight. When whirled around in one direction, the feathers may maintain their natural position in spite of their unstability; whirled in the other direction, they fly much better, but upside down. By fastening the line to the back instead of the front, the performance of the model will be quite different. Now remove the wire, enlarge the hole, and insert therein a straight tail feather; hitch the line on the projecting point of the quill, and whirl it as before, smoothly and with gradually-increasing speed, and note the change in its performance. Then try by turning the underside of feather up, and by replacing it with a screw.

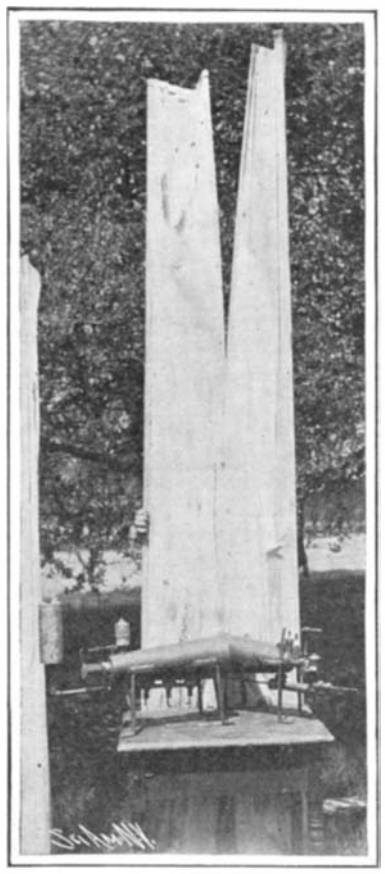
Such models formed the basis of hundreds of others and thousands of tests, from which sufficient information was gleaned to warrant building my aeromobile. This machine, for two persons, although specially designed for flight, is intended to travel also on land or water, propelled by a gasoline motor of 10 horse-power, which can be connected to drive the wheels, the water screw, or the air propeller.

Small feather models, as shown in the figures, supporting canoes, boats, cars, etc., containing ballast, have been experimented with, driven by novel propellers actuated by the recoil of rubber bands, gasoline motors, and driven by air blasts and rocket charges. The propellers were sometimes placed forward, at other times at the rear, and again both fore and aft, the center of effort generally being in line with the center of gravity, and fore and aft axis immediately below the center of support. The effect of various rudders placed both fore and aft, and free and held in different positions, was also tried; glides without any mechanical means of propulsion have also been extensively experimented with by casting them from an elevation on the air, both indoors and out and against, across, and with the wind and hitched to an elastic line fastened on a fishing pole, the experimenter walking and running a straight course with them in every direction, also by whirling them around the head during calms and winds. During these experiments notes were taken. It should be remembered that a whirled model is unfavorably acted upon by the wind, which strikes it successively on every side. These models, patterned after animated creatures that fly and swim, make good air-current indicators, and show that form is not confined to very strict limitations, and experiments with them clear the mind of much befogging theory, and greatly aid those grappling with the subject, for they offer a means of practically testing every theory and mathematical deduction in a quick, inexpensive, and easy manner.

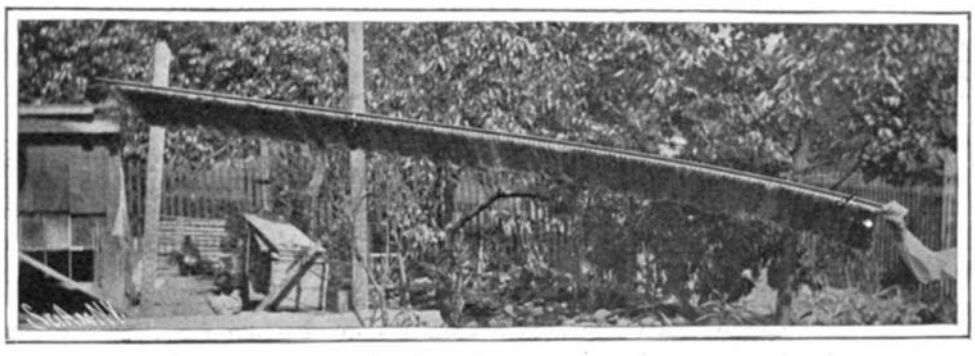
Scientists generally seek the solution of difficult problems by carefully studying nature's works, and I have tried to follow their example by building machines patterned after such pre-eminent sources as the condor, which in a few minutes of leisurely flight will sweep for many miles over mountains, rivers, and forests without any perceptible movement of its wings. Nature in dealing with the problem of flight furnishes wings and weight. Without the weight there could be no gliding and soaring, as any creature lighter than air would helplessly drift on the wind.



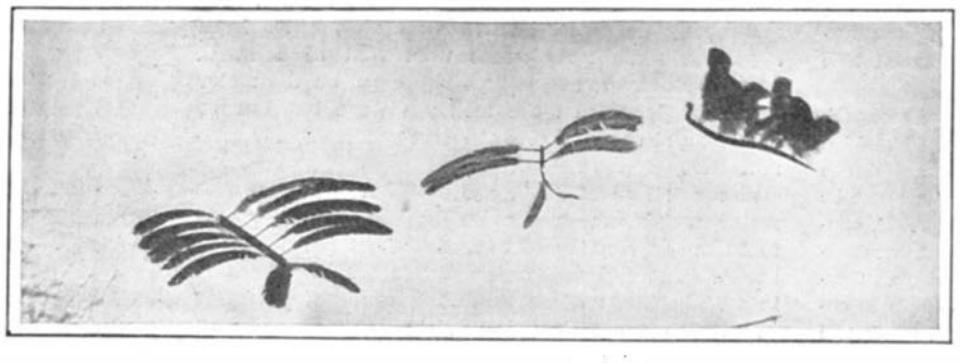
A Pair of 12-Foot Wings Provided with Feathers.



A Pair of Irish 1 and 4 Impulse Motors with 12-Foot Linen Wings.



A Wind-Supported 12-Foot Wing.



Feathered Aeroplanes in Flight.

FEATHERED FLYING MACHINES.

Spectra of the Electric Arc at High Tension.

In a paper read before the Société de Physique, M. de Kowalski gives an account of his experiments upon the spectra of the electric arc at high tension. The first researches were made upon the electric arc which was formed between metallic electrodes at high tension, and the author shows that his experiments agree with the theory of M. Stark. According to this, the electric arc commences to form at the moment when the temperature of the surface of the cathode is high enough to produce a sort of evaporation of the metal of the cathode. We may then expect that in the neighborhood of the cathode, the aspect of the luminous spectrum of the arc influenced by the metallic vapors will be different from the spectrum around the anode. It was also of interest to study the influence of the strength of the current upon the appearance of the spectra. Some new experiments were made in this direction. Not having direct-current dynamos of high enough tension, the author employs an induction coil for this purpose. In order to obtain an arc which will form between metallic poles with the anode and cathode well defined, the current from the induction coil must be dissymmetric to a certain degree, but this is easy to carry out by using a suitable current-interrupter. The turbine form with mercury jet is the best for this experiment. He used one which is made by the Allgemeine Company of Berlin. By its use we can employ high currents and can also measure the number of breaks per minute with precision. Photographs of the spectra were obtained by using a spectrograph with quartz lens and a Cornu prism. The experiment was disposed as follows: At a distance of about one inch from the spectrograph slit was placed the arc apparatus with its electrodes in cadmium or zinc. The poles were connected with the secondary circuit of the induction coil, with 0.6 inch distance between the electrodes. Thus he obtains an arc discharge at some 20 breaks per second with 6 amperes current in the primary circuit. A check spectrum is formed by putting a set of 0.003 microfarad condensers in parallel with the arc apparatus. The discharge is then changed to an oscillatory spark discharge. The spectrum of this latter is well enough known owing to the researches of M. Hemsalech, and it can be used as a comparison. The results which were thus obtained confirmed the suppositions of the author. The photographs show at first a band spectrum, the bands being due to nitrous vapors which are formed in the arc. But on the side of the cathode at the top we notice a set of strong broken lines which are due to the metal forming the cathode. These lines appear to belong exclusively to the cathode, and this is verified by reversing the current. They appear then at the bottom of the plate. The length of these lines depends on the strength of current in the arc. By increasing the current, certain lines traverse the whole top part of the spectrum, becoming wider on the side of the cathode. The study of the position of these broken or partial lines gives some interesting results. In the case of cadmium we observe the following lines: 5086, 4800, 4678, 3610, 3613, 3404, 3261, 3466, 3467. For zinc we have another series. We find that these lines are the same that M. de Watteville found in his remarkable work on plane spectra. They are identical with the characteristic lines of the spectra of metals evaporated in the cone of the plane. The line 3282 which is very weak in the flame spectrum of zinc appears very sharp in our spectra. All the facts clearly show the existence of metallic vapors in the region of the cathode and in a condition and a temperature analogous to those which are found in the cone of a gas flame.

Rose Powder.—As a base, as is ordinarily done in preparations of this nature, take 200 parts of powdered iris root, add to this 600 parts of rose petals, 100 parts of sandalwood, as many of patchouli, and only three parts of oil of geranium, and finally add two parts of true rose oil.

THE IMPROVED GRUHN TELAUTOGRAPH.

BY DR. ALFRED GRADENWITZ.

In a previous issue of the SCIENTIFIC AMERICAN a description of the Gruhn telautograph was published, an apparatus which is nothing more or less than a facsimile telegraph. This apparatus has been so greatly improved since the publication of that article as to bear little resemblance to the original apparatus. A description of the improvements may therefore not be amiss.

It is claimed for the new instrument that anybody, in fact any child knowing how to write, can use it without any training or skill.

The operative principle is illustrated in the diagram: An ordinary lead pencil, *t*, is connected with a very delicately mounted lever, *a*, so mounted that the writing end of the pencil can move over the writing paper in any direction without disturbing the writer. The other end of the lever is fixed within the casing to a shaft, *p*, which can be displaced on the line, *A B*, so that the pencil can move in any direction. The motion performed by the pencil will impart to the lever a rotary in addition to a reciprocating movement.

A stationary resistance is represented by *r*, a movable resistance by *s*, rigidly connected with the lever, *a*, by the rods shown in the diagram. The two resistances are connected with a battery of eight dry cells. A small current collector, *b*, is fixed to the movable rods and insulated from them, while *c* is a fixed current collector bar. The two current collectors are fixed to the transmission wires, *d* and *e*. Now, each of the collectors will throw into the transmission lines a part of the battery current; the amount, so far from being constant, will obviously undergo alterations with any variation in the position of the writing pencil. To each point of the writing board will thus correspond two given current intensities in the two lines respectively, so that the writing movement can be said to be converted into current variations.

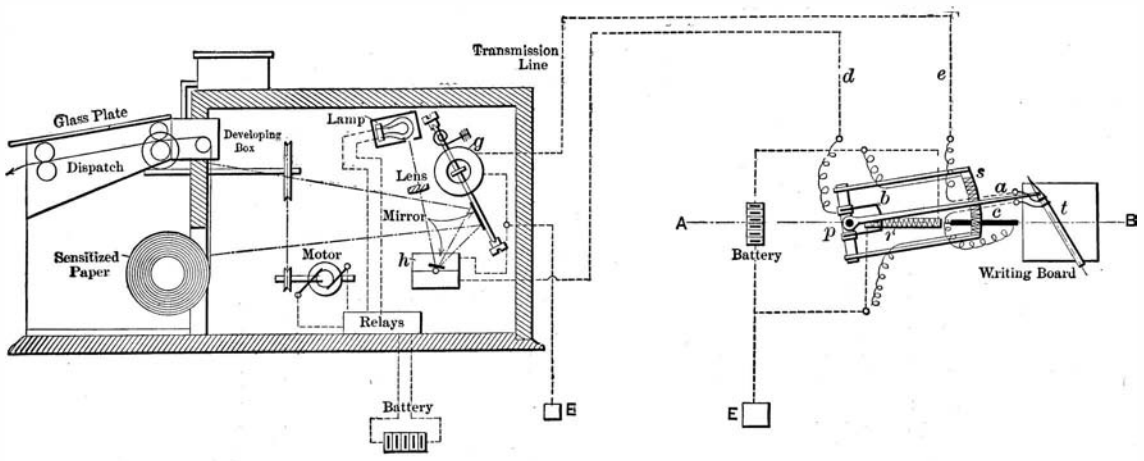
Now, the spiral lines represent flexible conductor strings. The transmitted current returns either through the ground or through a third conductor. In the receiving station the currents are received by an apparatus including a small electric lamp which projects a thin beam of light on a very small mirror, whence the beam is reflected to a second mirror, which again reflects it to a sheet of sensitive photographic paper. On this paper the beam of light is sharply focused by a lens. The two small mirrors, so far from being stationary, are moved under the influence of the currents transmitted from the sending station. In fact, they are mounted on small rotary shafts, to which are fixed magnetic rods, set vibrating by the arriving current through the medium of the coils of copper wire, *g* and *h*. Now, one of the mirrors will vibrate from above downward, and the other from the right to the left, according to the movement of the writing pencil in the sender. The reflected beam will accordingly perform the two component movements, which are combined into what may be called a resulting motion.

From the foregoing it will readily be understood that the beam of light can be controlled by means of the two mirrors, so as to perform the same movements as the writing pencil in the transmitting apparatus; in fact, the movements of the latter are translated in the transmitter into a vertical and a horizontal component; these are combined in the receiver again to reproduce the original motion. The beam of light thus acts as a luminous writing pencil, moving over the paper simultaneously with the graphite pencil and at the same speed, so that a photographic record is obtained on the receiving paper.

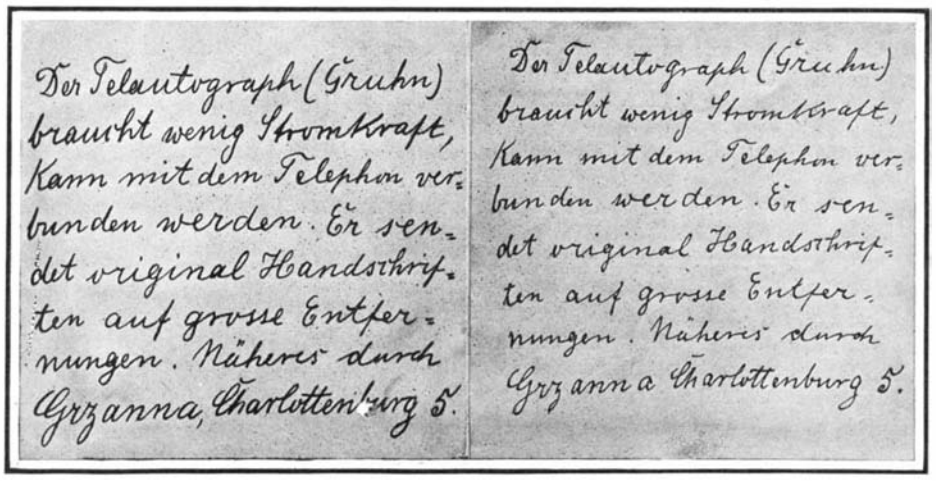
A special feature is that the photographic record is developed automatically by the apparatus. A small electromotor withdraws the message automatically from the receiver box, the whole developing process lasting only ten seconds. That is to say, that ten seconds after the operator has put down his writing pencil, the dispatch is received in the original writing at the other station, and the receiver has only to read his photographic telegram. Every apparatus being designed both for the receiving and sending of telegrams is a double apparatus, constituting a complete station outfit. The most obvious advantage of the apparatus is that it generally requires no special wiring, but is simply connected with existing telephone circuits. In fact, the telautograph necessitating two main lines and one return, any one of the reserve lines that are always available can be used as return. Since this reserve line can be used simultaneously by a number of telautographs, connected with the same conductor, there will in most cases be no necessity for installing special lines for the telautograph. The returns need not, by the way, be led through the switchboard of the telephone exchange, but can be kept connected with one another permanently, which will greatly facilitate the introduction of the apparatus. Moreover, a recent improvement enables the apparatus to work on two lines only.

Trials made by the German postal department have shown the possibility of telephoning and writing simultaneously on the same wire, without the two apparatus interfering with each other. As, moreover, the telautograph has been found to work successfully over great distances (trials have for instance been made between Berlin and Dresden, over 124 miles distance) it will doubtless prove a valuable complement to telephone service, especially in cases where the latter would not be sufficiently efficient.

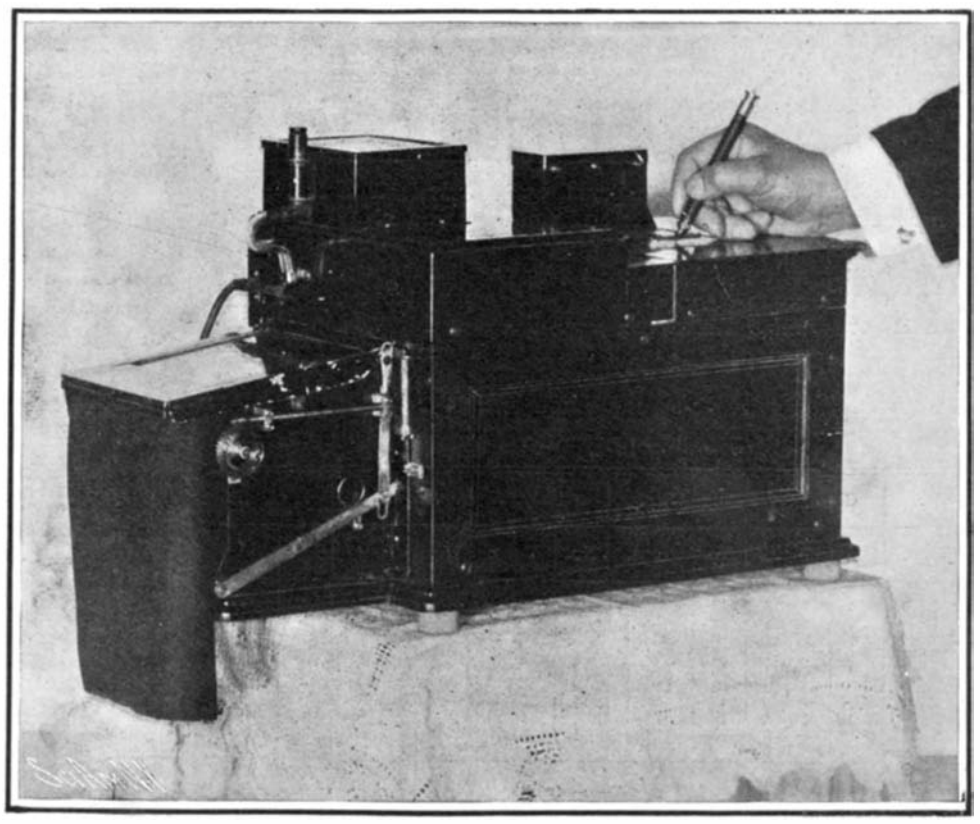
It should be mentioned that the telautograph shows a low consumption of current, eight dry elements being sufficient to supply the apparatus for a long period, the battery being connected only just the time the apparatus is used for writing. As the telautograph and telephone are normally connected simultaneously and permanently with the same circuit, no switching is required from the telautograph to the telephone, or *vice versa*, and telephoning and telautographing can go on either simultaneously or alternately. The writer is indebted to Mr. Gustav Grzanna for courtesies extended in the preparation of this article.



The Combined Transmitter and Receiver of the Gruhn Telautograph.


Der Telautograph (Gruhn) braucht wenig Stromkraft, Kann mit dem Telephon verbunden werden. Er sendet original Handschriften auf grosse Entfernungen. Näheres durch Grzanna, Charlottenburg 5.
Der Telautograph (Gruhn) braucht wenig Stromkraft, Kann mit dem Telephon verbunden werden. Er sendet original Handschriften auf grosse Entfernungen. Näheres durch Grzanna Charlottenburg 5.

Original and Transmitted Messages, One-Fourth Natural Size.



THE IMPROVED GRUHN TELAUTOGRAPH.

Tubes in Cement.

The tubes or piping of cement which is now manufactured appears in numerous forms of section. Besides the round piping we also meet with piping of an oval section. The circular piping is generally used for diameters which are below 20 inches, while for the large sections the oval form is preferred. To give it a greater steadiness upon the bottom where the piping is laid, the exterior contour is often given a flat base instead of being circular like the internal bore. Such piping can be readily placed upon a flat surface and will keep well in place. As at present constructed, the cement piping is formed of an agglomerate mixture consisting of cement and an inert element, sand or gravel. A mortar is made by mixing these two constituents. For the cement we can take Portland, Roman cement, or others. The mixture is quite variable in the proportions which are used, and should be made according to the following rules: First, to have a compact beton, the gravel should be double the amount of sand. Second, the solidity is lessened when we only use cement and gravel, excluding the sand. Third, by diminishing the quantity of gravel too much the expense is increased. The best proportion for average use seems to be 1 part cement, 1.8 sand, and 4.4 gravel. After deciding the proportion to be used, we next carry out the mixing of the materials. A kind of mixing crusher can be employed, in which narrow rollers work in a vat containing the mixture. We can also use mixers composed of a hollow, cylindrical vessel in which turns a shaft provided with paddles. Such an apparatus takes some 7 horsepower, and it forms 24 cubic yards of beton per hour. Once the mass is mixed it is put in an iron mold of appropriate form, consisting of the outer form and an inner core corresponding to the diameter of the piping. The mixture is put in the free space and is packed down with a tamping rod. The process somewhat resembles the manufacture of gas retorts. The forms are placed vertically or laid down. For some time it has been desired to substitute a mechanical process for the hand method, which is expensive, but machines which have given good results are scarce as yet. They have somewhat the same form as the molds just described. Beton is run into the inner space. The core is set revolving, while the mass is compressed by a screw-press. The tube is then taken out of the mold and at the end of three or four hours is treated with a fluosilicate containing magnesia. To protect the tubes from corrosion by acids it is a good plan to coat the inside with a mixture of tar and asphalt.

There are 200 companies who make machines for molding of concrete blocks.

SEA STRENGTH OF THE NAVAL POWERS.

One of the most important items of information, drawn up annually by the United States Office of Naval Intelligence, is a table giving the comparative sea strength of the principal naval powers. Comparisons of this kind are frequently made by writers on naval subjects, and by the various governments that have important naval interests. The basis of comparison adopted varies widely, according to the point of view or method of classification adopted. We consider that the classification used by the Office of Naval Intelligence is, all things considered, the best of these. The system of comparison is based chiefly on displacement and age.

The ships are classified under nine heads. First, battleships of the first class, including those of about 10,000 tons or more displacement; second, coast-defense vessels, including the smaller battleships and monitors; third, armord cruisers; fourth, cruisers above 6,000 tons; fifth, cruisers of from 6,000 to 3,000 tons; sixth, cruisers of from 3,000 to 1,000 tons; seventh, torpedo-boat destroyers; eighth, torpedo boats; and ninth, submarines. Referring to the term cruisers, as used in three of the above classes, it should be noted that all unarmored warships of more than 1,000 tons are classed, according to displacement, as cruisers. Scouts are considered as cruisers in which battery and protection have been sacrificed to secure extreme speed. The term "protective" has been omitted, because all cruisers, except the smallest and oldest, now have protective decks.

It should further be noted that in this comparison the following vessels are not included: Those over twenty years old, unless they have been reconstructed and rearmed; those not actually completed; gunboats and other vessels of less than 1,000 tons, since these vessels have so slight a military value as part of a fleet; and lastly, torpedo craft of less than 50 tons displacement.

The illustration on the front page of this issue is based upon the last table of this kind that was drawn up by the Office of Naval Intelligence, and represents the relative strength of the world's navies on January 1, 1905. The illustration agrees with that document except as regards the gains and losses of the Russian and Japanese navies, which have been introduced into the table to show the relative standing of these two powers as affected by the war. Before the war, or rather after it had been waged for eight months, the order of strength was Great Britain, France, Russia, Germany, United States, Italy, Japan, Austria. As the result of the war, Russia has fallen from third to seventh position, or next to Japan, the order now being Great Britain, France, Germany, United States, Italy, Japan, Russia, Austria.

For the reason that it is the ships actually completed upon which a navy must depend on the opening of a war, we have based our illustrations exclusively upon the tables of ships that are built. Any comparison that includes the ships that are building is apt to be misleading; for the value of ships that are under construction as a military asset depends entirely upon the rapidity with which construction in the particular country concerned is carried on, and the liberality with which the government makes the necessary appropriations for such construction. One nation may take but three years to complete a ship, where another would take five or six. Moreover, a nation might have as much tonnage under construction as is completed, which is the case with the United States, and might yet, at the hands of a superior naval power possessing an overwhelming superiority, suffer such an initial reverse that no amount of activity in completing the other and larger half of the navy, that was upon the stocks, could retrieve the disaster. This was largely the case with Russia, which at the outset of the war possessed a tonnage of ships under construction approximately equal (if we except the Black Sea fleet) to the tonnage of the completed ships of her navy, that were of strictly modern construction.

On the basis of tonnage actually afloat, then, January 1, 1905, Great Britain stood first with 1,595,871 tons; France was second with 603,721 tons; Russia third with 447,315 tons; Germany fourth with 441,249 tons; the United States fifth with 316,523 tons; Italy sixth with 254,510 tons; Japan seventh with 220,755 tons; and Austria eighth with 112,336 tons. Russia has lost, either by destruction, capture, or internment in neutral ports, just one-half of her total, so that now the displacement of all ships in her navy is 224,237 tons. As a matter of fact, she has lost more than this; because the total given includes some few vessels that have been completed in the interim. Japan, remarkable to relate, has come out of the war with about 32,000 tons more than she had at the close of last year, the figures being respectively 220,755 tons on January 1, 1905, and 252,661 tons at the present time. With regard to the Russian totals, it should also be mentioned that, because of treaty restrictions, over 93,000 tons of battleships, being confined to the Black Sea, is excluded from taking part in naval operations on the high seas. This would leave Russia with a total tonnage of 131,237 tons that can be employed in any naval operations that might mark the immediate future of the war. The effect upon the relative strength of the two combatants of the terrific fighting that has taken place in the past eighteen months, is shown in the graphic comparison of the displacement of the two fleets in 1904 and at the present time.

In conclusion it must be noted that the large number of vessels interned in foreign ports will probably be handed over to Japan in lieu of, or as part of, an indemnity. In this case the Japanese navy would be further increased by one battleship, five cruisers, a gunboat, and ten torpedo boats; an addition which would bring its total displacement up to 300,521 tons. This would give Japan a considerable lead over Italy, and would bring her within 16,000 tons of the total of the United States on January 1, 1905.

If Japan secures an indemnity, she will undoubtedly put a large part of it into battleships and armored cruisers; in which case she will become a formidable competitor with the United States or Germany for the third or fourth place among the navies of the world.

The Current Supplement.

The current SUPPLEMENT, No. 1540, opens with an excellently illustrated article by Dr. Alfred Gradenwitz on the Parsons Steam Turbine on German Warships. While carbon has heretofore been almost exclusively used commercially in both arc and incandescent lamps, the earth oxides have recently been found to possess desirable properties for use as electric illuminants. Mr. Murray C. Beebe takes these rare earths as the subject of a very exhaustive discussion. A highly instructive article is that on stereoscopic projections. There was recently held in London an optical convention which was of considerable scientific moment. It was presided over by Dr. R. T. Glazebrook. His presidential address on the progress of optical science and manufactures is published in full. The remarkable address delivered before the Committee on Military Affairs of the House of Representatives by Major Seaman, M.D., on army sanitation in Manchuria is abstracted. Up in the Lake districts, where the season of open navigation lasts but a few months, the problem of handling coal for current needs, and of storing a sufficient quantity to meet the requirements during the months when coal cannot be transported, is one of great importance. How this problem has been solved at South Lake Linden, Mich., is described by J. A. McIntyre. How unconsidered trifles may be utilized is told in a breezy, entertaining way. The Bakerian lecture delivered before the Royal Society dealt with the reception and utilization of energy by a green leaf. The lecture is abstracted in the SUPPLEMENT. The English correspondent of the SCIENTIFIC AMERICAN tells of some recent developments in the application of liquid fuel to marine boilers.

New Process for the Electrolytic Manufacture of Soda.—The electrolysis of sea-salt for the production of soda has been inaugurated by M. Granier by substituting for anodes of charcoal anodes of copper, so as to obtain a chloride of copper at one of the poles, instead of chlorine. The copper chloride is converted readily into sulphate of copper and hydrochloric acid.

Electrical Notes.

A hydro-electric plant is in project for supplying the city of Burgos, Spain, and the power is to be taken from a point some thirty miles from the city by a station which will be erected at Quintanilla Escalada. The river Ebro and the Rudron, its affluent, are to furnish the power. Under a head of water of 80 feet and a flow of 2,000 gallons per second, a total of 1,500 to 2,500 horse-power can be secured, according to the season. The central station is to be equipped with three turbine and dynamo groups with Francis turbines made by Escher, Wyss & Co., giving 370 horsepower each, coupled direct to three-phase alternating-current dynamos. The latter will give current at a tension of 3,300 volts. This tension will then be raised by a set of transformers to 30,000 volts, in order to supply the high-voltage overhead line, which goes from the station to Burgos. The transmission line will have three bare copper wires carried on porcelain insulators. Where the line enters the city there will be a sub-station containing apparatus for lowering the tension to 5,000 volts. Other sub-stations at different places in the town will receive this current, and transform it to 120 volts for the usual consumption.

Experiments on the Electrolytic Deposition of Zinc.—The experiments of M. Gabran for obtaining rapid deposits of zinc show that the electrolyte giving the best results is composed of 1,200 parts of zinc sulphate, 60 parts of sulphuric acid of the strength of 24 deg. Baumé, and 6,000 parts of water. With this electrolyte and densities of current varying from 2 to 3 amperes per square decimeter, clear, solid deposits of zinc were obtained. The tension of current was 1.5 to 2.5 volts. In other experiments the tension extended to 6 amperes per square decimeter, without injuring the quality of the deposit, the voltage being from 9 to 10 volts. Crystals of zinc were formed on the borders of the cathode, but this did not prevent its being covered with a very adherent deposit of zinc.

Electrolytic Manufacture of Chlorates and Perchlorates.—The electrolysis of salts of chloride of potassium and of sodium for the production of chlorates was inaugurated by MM. Gall and De Montlam at Villers-sur-Herme in France in 1889 and afterward at Vallorbes in Switzerland in 1890. It has extended until there are at least ten factories in Europe with an aggregate of 30,000 horse-power. There are five different types of elementary or electrolytic cables, but they differ only in the details of construction.—L'Electrochemie.

The Allgemeine Elektricitaets-Gesellschaft, of Berlin, have brought out a new form of electric resistance. It is formed of an insulating and incombustible body having a high thermic capacity, such as a composite clay, upon which the wire forming the resistance is wound. The whole is enveloped in a body which has a great heat-radiating capacity, such as carborundum combined with water-glass. Owing to their high thermic capacity, these resistances may be used to advantage for starting motors, as they can stand a very high overload for a short time, about 100 amperes per square millimeter, for instance. When the resistances are built up in a regulating apparatus, they will take a heavier current than the usual German silver or iron coils, for the black mass of the carborundum increases the radiating surface greatly. In this connection we may mention an improvement which M. Preuss and others have made in the matter of electric resistances composed of powdered material. In this form the degree of resistance to the current is changed by means of a contact plate which plunges into the mass and can be raised and lowered. As it is displaced, this plate produces an uneven disposition of the material and after some use the contact between the powder and the plate becomes insufficient and sparks are apt to be produced. To avoid this the inventors adopt a device which gives a shock to the apparatus after each time of shifting the plate, and thus the powder is restored to its original state. The shock is produced by a striker which comes against the box each time the main lever is shifted.

Of the eight civilized tribes in the Philippines, the largest is that of the Visayans, who occupy most of the islands lying between Luzon and Mindanao, and form nearly one-half of the entire civilized population. Tagalogs occupy the provinces in the vicinity of Manila. They rank second, with a little more than one-fifth of the civilized peoples, and the Ilocanos rank third, with approximately one-eighth. Among the wild tribes the Moros are the most numerous, comprising about two-fifths of the non-Christian population.

Even among the Christian tribes the tribal distinctions are clearly marked. The members of the different tribes rarely mix in villages or intermarry, and, with the exception of the Ilocanos, who have migrated from their original territory and settled in neighboring provinces, the people show little tendency toward expansion or colonization.

COMPARATIVE SEA STRENGTH OF THE NAVAL POWERS ON JUNE 1, 1905.*

NUMBER AND DISPLACEMENT OF COMPLETED WARSHIPS OF 1000 TONS OR MORE, AND OF TORPEDO CRAFT OF MORE THAN 50 TONS.

Type of Vessel.	Great Britain.		France.		Germany.		United States.		Italy.		Japan.		Russia.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Battleships, first class	51	682,200	19	212,589	16	178,575	12	137,329	13	162,314	5	70,516	7	82,809
Coast defense vessels	6	49,900	17	73,368	16	91,315	12	47,445	1	3,913	5	29,527	7	43,391
Armored cruisers	29	282,400	18	145,085	4	39,047	2	17,415	5	31,891	8	72,738	3	31,288
Cruisers above 6000 tons	21	201,950	4	31,513	....	.....	2	14,750	....	.....		.....	4	25,911
Cruisers 6000 to 3000 tons	50	221,460	18	74,378	9	46,749	16	58,279	5	17,490	11	42,596	3	12,593
Cruisers 3000 to 1000 tons	56	103,960	18	32,868	27	58,859	21	29,497	12	26,216	11	21 276	7	8,760
Torpedo boat destroyers	126	44,565	31	9,250	37	12 660	16	6,695	11	3,503	22	7,4°6	33	10,000
Torpedo boats	90	8,036	238	20,735	105	13,924	27	4,200	101	9,076	81	7,317	82	8,000
Submarines	9	1,400	37	3,935	1	120	8	913	1	107	11	1,265	13	1,485
Total tons built	.....	1,595,871	.....	603,721	.....	441,249	.....	316,523	.....	254,510	.....	252,661	.....	224,237

* The figures for Russia and Japan have been revised to include the changes brought about by the gains and losses during the war.

Correspondence.

A Lunar Rainbow.

To the Editor of the SCIENTIFIC AMERICAN:

A curious and unusual phenomenon, in the form of a rainbow for which the moon instead of the sun furnished the light, was observed here on the night of June 19. A heavy rainstorm, accompanied by considerable thunder, occurred just before moonrise. As the clouds retired to the west, the luminary rose and the bow was first observed, only the extremities for about 25 degrees being visible, the moon at that time being concealed behind a small cloud. For about twenty minutes, the bow increased in brightness, and at the end of that time could be clearly traced throughout its entire length. At each end the red and blue colors could be plainly distinguished, but the remainder of the arc showed only as a light streak across the clouds. The conditions for the phenomenon were almost ideal, the moon being but a few days past full, the cloud screen occupying the proper position, and, as it occurred just at moonrise, the bow was seen well up in the heavens. After the clouds had almost entirely melted away, leaving only a slight haze through which the stars shone, portions of the bow could still be clearly discerned. CHARLES N. WILSON.

Poulan, Ga., June 20, 1905.

How to Save Niagara.

To the Editor of the SCIENTIFIC AMERICAN:

There has lately been much discussion on how to save Niagara Falls. I take here the liberty to describe a method for utilizing the greater part of the energy in the falls without injuring in the least the beauty of the falls and without necessitating any engineering structures in the vicinity of the falls.

Suppose a dam, constructed across Niagara River, a few miles above the falls or at the beginning of the river. Let the gates of the dam be closed half of the time and opened half of the time, making the river flow, say for instance, twelve hours in daytime. There would be no danger of overflow, when the gates are shut, with the large area of Lake Erie above the dam. It is evident that twice the regular flow of the river could be extracted from Lake Erie in the daytime. Let the regular flow pass over the falls and take a quantity equal to half the regular flow continually for power purposes. This would give about 3,500,000 horse-power without injuring in the least the beauty of the falls. The gates of the dam could be open, say nine hours in the day and three hours in the night, in order to make it possible to see the falls also at night. It seems to me that if these arrangements were possible, it would give a great amount of power and at the same time save the destruction of the falls.

LOUIS L. THUNSTROM.

Jamestown, N. Y., June 20, 1905.

Automobile Notes.

An ingenious device for automobiles, the object of which is to reduce the impact and dangers of collision, has been invented by Mr. F. R. Simms, of London. The protector is a spring buffer and is built up of two segments of pneumatic tires, which are mounted on the long blade springs attached to the front of the side portions of the frame of the vehicle. In the event of a collision the pneumatic tire serves to minimize the shock, while the springs which yield to the outer side have the tendency to throw any object with which they come into contact outward away from the automobile. Some interesting tests have been carried out with the invention by charging the vehicle against small carts, and in each case the object was hurled out of the path of the car, while the force of the impact was considerably reduced.

During the present week—on July 5—there occurs in France the sixth annual international automobile road race for the Bennett trophy. The race will be run over a 340½-mile course, known as the Auvergne circuit, and noted for its many sharp turns and narrow stretches. The machines which will represent France are those which made the best performance in the eliminating trial held recently on this course, viz., two 96-horse-power Richard-Brazier cars, driven by Théry and Callois, and a 130-horse-power de Dietrich racer. The first-named won the race for France last year, and in the trial mentioned covered the distance in 7 hours, 34 minutes at an average speed of 45 miles an hour. A 140-horse-power Locomobile racer driven by Tracy and two 50-horse-power Pope-Toledo cars have been sent to France to represent America. The English team, selected as the result of an eliminating trial on the Isle of Man, consists of a 90-horse-power Napier and two 90-horse-power Wolseley cars having four-cylinder horizontal motors. The German and Austrian teams each consist of three powerful Mercedes machines, while Italy is represented by three Fiat cars.

A striking illustration of the speed and endurance qualities of a French racing auto was had recently by the 1,000-mile trial of a 40-horse-power Decauville machine that was made on the Empire City track. The car in question, although three years old, lowered the record 2 hours, 16 minutes, and 41 seconds. The new time is 23:33:20; and this was made despite the fact that there were several showers in the early morning of the day of the finish, which made the track so muddy that it was unfit for racing in the afternoon. At the end of 500 miles, Guy Vaughn, the driver, was 1 hour, 45 minutes, and 52 seconds ahead of the record, but he was unable to continue the same rate of time cutting, owing to the bad going later and stops for supplies and tire repairs. Out of a total of thirteen stops, five were occasioned by tires. The right front tire gave out once, and the left rear tire twice in the total run of 1,015⅝ miles, which was made in 24 hours. The other two tires went the distance without repairs. The running of the car was very regular indeed, and often for 50 miles at a stretch the time per mile would vary only a fraction of a second. An average speed, exclusive of stops, of 45½ miles an hour was maintained.

In contrast to the numerous races and race meets that are being held almost daily are the two touring events, which will take place within a few days under the direction of the American Automobile Association. One of these tours, from Chicago to St. Paul, started on June 30 and July 1. The other tour will be from New York to the White Mountains and return—a distance of 1,000 miles—for the Glidden trophy. This trophy, which was donated by Mr. Charles J. Glidden (who has recently completed a tour of the world *en auto*), is to be presented annually to the car making the best performance in a 1,000-mile tour. In the present instance, the routes have been carefully gone over, and a route book giving them in detail will be furnished each contestant. Arrangements have been made for the accommodation of the motorists at reduced rates, and their machines will be given free garage accommodations at Bretton Woods, where a stop of five days will be made, during which time (on the 17th and 18th) the second "Climb to the Clouds" up Mount Washington will be held. In both of these tours the contestants will be allowed to suit their own convenience as to when and how fast they travel, the only conditions in the Glidden tour being that they shall start between 6 and 10 A. M. and finish by 9 P. M. each day. An entrance fee of $50 is charged for this event. Among the representative American touring cars entered are four White steam machines, three Maxwell tonneaus, two Pierce, Peerless, and Packard cars, and a Winton, Rambler, Cadillac, Pope-Tribune, Pope-Hartford, and Pope-Toledo. There will also be a considerable number of foreign cars, among which may be mentioned a four and a six-cylinder Napier, a Mercedes, a Decauville, and a Panhard. An opportunity will thus be given to compare the performance of the best American, English, and French touring cars upon good roads.

Some interesting data as to the cost of running an automobile on smooth, level roads were obtained recently in an economy test held by the Long Island Automobile Club. A run from Brooklyn to Southampton and back (180 miles) was made in two days, and the cost per capita of passengers was figured out for each machine. The charges made against the machines were as follows: Gasoline, 25 cents per gallon; oil, 50 cents per gallon; tire repairs, 50 cents an hour; punctured inner tubes, 75 cents; chain repairs, 50 cents an hour. On this basis, a 10-horse-power Franklin tonneau carrying four passengers weighing 600 pounds and 50 pounds of baggage, covered the distance on 9¾ gallons of gasoline and 7 pints of oil, at a total cost, including ½ hour tire repairs, of $3.22, or $0.805 per capita, as against $4.53 railroad fare for the round trip. A 30-horse-power Pope-Toledo carrying five passengers was second, with a total cost of $4.42 and a cost per passenger of $0.885; while third place was taken by an 18-horse-power Northern carrying four, at a total expense of $3.95, or $0.9875 per capita. The four-cylinder, air-cooled Franklin covered 18.46 miles per gallon of fuel consumed; a single-cylinder 10 horse-power Cadillac carrying four and obtaining fourth place, was next with a record of 17.56 miles per gallon; while an 8½ horse-power car of the same make carrying but two did only a little better—18 miles per gallon. A four-cylinder, 24-horse-power Pope-Toledo car made 15 miles per gallon, while the 30-horse-power car that took second place made only 10.43. A two-cylinder Northern having a horizontal, double-opposed motor and direct bevel-gear drive covered 12.85 miles per gallon. Two White steam cars with four passengers each made respectively 9 and 7.2 miles per gallon. In striking contrast with these figures are some which were obtained in Great Britain recently. In the Scottish reliability trials the Arrol-Johnston four-passenger dos-a-dos covered 31.1 miles per gallon, which was equal to 43.6 ton miles per gallon, as against 35.37 ton miles accomplished by the next best car. Mr. S. F. Edge tried the experiment of putting one gallon of fuel in the tank of a four-cylinder, 20-horse-power Napier and running the car to a standstill. By repeating this process several times he ran an average of over 25 miles for each gallon, and once he covered exactly 27 miles. Such widely-varying results can not be due altogether to the roads or to the mode of operation of the car. They should cause our manufacturers to investigate and find the underlying reasons for the greatly reduced consumption of some automobiles. In the case of the small car mentioned, the makers lay it to an improved transmission gear, which delivers 66 to 70 per cent of the power of the motor at the rims of the wheels.

Engineering Notes.

A company has been formed at Berne, Switzerland, with a capital of $500,000 for manufacturing a new kind of combustible from peat. The new material, which is claimed to have the same value as coal, is formed according to the electric process invented by Count Botho von Schwerin. The peat is dried under the influence of the electric current and then further treated so that under the action of electric osmose a new compound, known as osmon, is formed. A description of the process has already been given. The most recent tests of the new combustible bring out the fact that it burns as well as coal and without giving any odor. The ash is very small. As it does not contain any trace of sulphur, it does not attack the boilers. Besides, as it is consumed without giving off smoke, it is well adapted for boiler furnaces and in practically all cases. The proposed plant, which is to be erected in Switzerland to produce the "osmon" briquettes, will no doubt be erected in the large bog region near the Orbe, which will give a supply for a long time to come. Some one hundred tons a day are to be produced at first, and afterward this may be doubled.

Prior to 1860, railroad bridges were generally designed by the railroad companies' engineers, the ironwork being manufactured at the companies' shops, and erected by their own forces. Thus, men like Wendell Bollman, Albert Fink, Past President, Am. Soc. C. E.; C. Shaler Smith, M. Am. Soc. C. E., and C. H. Latrobe, M. Am. Soc. C. E., on the Baltimore and Ohio Railroad; Richard B. Osborn and Charles Macdonald, M. Am. Soc. C. E., on the Philadelphia and Reading Railroad; J. H. Linville, on the Pennsylvania Railroad; E. S. Philbrick, on the Boston and Albany Railroad; George E. Gray, Howard Carroll, and Charles Hilton, on the New York Central Railroad; Willard S. Pope, M. Am. Soc. C. E., on the Chicago and Northwestern Railroad; Thomas C. Clarke, Past President, Am. Soc. C. E., on the Chicago, Burlington and Quincy Railroad; S. S. Post, M. Am. Soc. C. E., on the Erie Railroad, were prominent railroad engineers who took a leading part in early bridge building. Later, some of the men who had gained experience in framing and erecting bridges, or in the construction of the work at the shops, started in business for themselves, and took contracts to build and erect bridges on designs furnished by the railroad companies' engineers. Most of those early firms were contractors for building Howe truss bridges, only a small shop being required to manufacture the ironwork needed for structures of that class.

Some interesting experiments are being carried out at Torquay (England) with the model of a new type of breakwater. It is constructed upon the floating principle, this system having been adopted by the inventor, in view of the fact that the disturbance caused by storms only affects the sea to a depth varying from 12 feet to 15 feet. Beyond that depth the water is comparatively calm. The experiments at Torquay are being made with a frame, designed for the purpose, floated by pontoons and securely moored. Assuming that a breakwater is needed a thousand yards long, in water 60 feet deep, a strong frame is made to penetrate to a depth of about 40 feet. Sufficient weight is given to the structure to insure its stability and to provide the necessary ballast. The frame is buoyed by means of pontoons placed on the inner or land side. Thus the structure is tilted toward the sea. The frame is moored on both sides by chains of considerable length, which are attached to its lowest part, and which lie as nearly parallel to the seabed as is practicable, in order to obtain the best holding power. When a sea strikes the frame, it works back on its chain as a door works on its hinges, thus lessening the force of the sea, and when the sea is broken the structure floats back to its original position, ready to receive the next sea. Obviously, a stone and concrete breakwater must be strong enough to receive the full shock of the sea, and this force the structure devised by this inventor, in consequence of yielding, renders less formidable. On the inner or land side there is also a horizontal network, supported by pontoons, and fixed to the structure, in order to break any sea that might wash over it. Fears have been expressed that the sea may wash the structure away; but the inventor contends that as buoys and pontoons fastened by a single chain ride through the severest storms without breaking adrift, there is nothing to prevent a sufficient number of chains being fixed to his device to render the structure absolutely secure.

ANCIENT CHALDEAN REMAINS FOUND IN RECENT EXCAVATIONS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

M. de Sarzec was appointed vice-consul of France at Bassorah, and during his stay in that country managed to explore the historic region traversed by the lower course of the Euphrates and Tigris rivers. He chose the locality known as Tello, as it was covered with high mounds, which no doubt covered many ancient ruins. In the largest mounds he uncovered the walls of the principal edifice, which afterward turned out to be the palace of the Chaldean king Goudea, according to many inscriptions. The palace is built of red and yellow baked bricks, which were cemented with bitumen. It formed a rectangle 170 feet long and 100 feet wide. The paving throughout the palace was of baked brick. It had many rooms, and the main court measures about 40 feet square.

In and near the palace were found a number of life-size statues of King Goudea in a dark green stone resembling diorite. The statues were covered with cuneiform inscriptions, and two large clay cylinders covered with characters were also found.

Many of the pieces found by M. de Sarzec were brought to Paris, where they were examined by M. Leon Henzey and other eminent savants. They are now placed in the Louvre, and fresh pieces are being added to the collection. We will commence with the oldest piece of all, which is the fragment of bas-relief shown in one engraving. It is a work of the highest antiquity, and should be placed at the head of the whole Asiatic series. It is undoubtedly the most ancient piece of Chaldean sculpture which has yet been found, and represents the beginnings of an art whose development we can trace through the different later periods. The piece is no doubt a fragment of a larger composition in which there were a number of persons. It contains a beardless figure which is seated on the left. In spite of the crude drawing of the profile, it seems to represent a female figure. The head-dress is of a simple form and resembles the characteristic two-horned Chaldean head-dress which is found elsewhere. The gesture seems to be addressed to a smaller figure which is half broken off. Apparently, it represents a child which is placed upright above the woman's knees. The subject is probably one of the goddesses which the Chaldean and the later Assyrian myths associated with a divine infant.

Fragment of Vulture Stele, Front Face.

Different pieces belonging to the reign of Ur-Nina (about 4000 B. C.) were also found. One of the most remarkable of these is an oblong slab about 20 inches long and 16 wide, with a hole in the center. The exact use of such a piece is uncertain. One of the illustrations shows the stone; it is engraved with a historic subject, and represents the king Ur-Nina surrounded by his children and principal servitors. The inscription in front of the king reads: "Ur-Nina, king of Sirpourla, son of Nini-hal-dou—the temple of the god Ghersou—has built." For this reason he is shown bearing the sacred basket, which is symbolic of the temple building, after the manner of our inaugural ceremonies. The inscription reads: "Ur-Nina, king of Sirpourla—the temple of the goddess Nina—has built." The union of the inscription and figures thus forms a historic and genealogical document of the highest value. Perhaps it is the oldest illustrated record of authentic history. Another engraving shows a smaller stone bearing somewhat the same subject, along with two alabaster vases with archaic inscriptions.

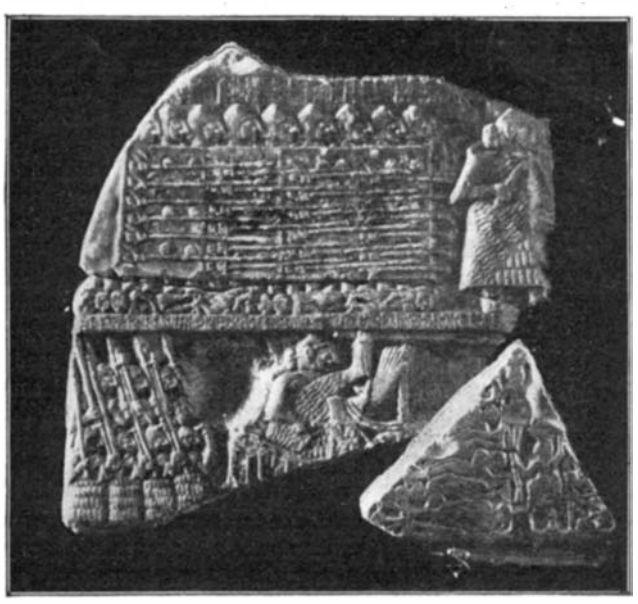
Smaller Tablet of Ur-Nina and Two Alabaster Vases with Inscriptions of the Same Epoch.

After Ur-Nina comes his grandson Eannadou. Of his reign we have a most remarkable monument in the shape of a great stele, which must have been originally of unusual size. It is covered with sculptures representing battle scenes. Some of the fragments are here illustrated. The stele is a great slab of white limestone, somewhat rounded at the top. We have only a few fragments of the stele, which must have been originally 5 feet wide and 7 or 8 feet high. The flat ground of the slab contains the inscription, and the sculptured figures stand out in low relief. The soldiers in the front rank form

Tablet of Ur-Nina, King of Sirpourla. (4000 B. C.) Its Purpose is Uncertain.

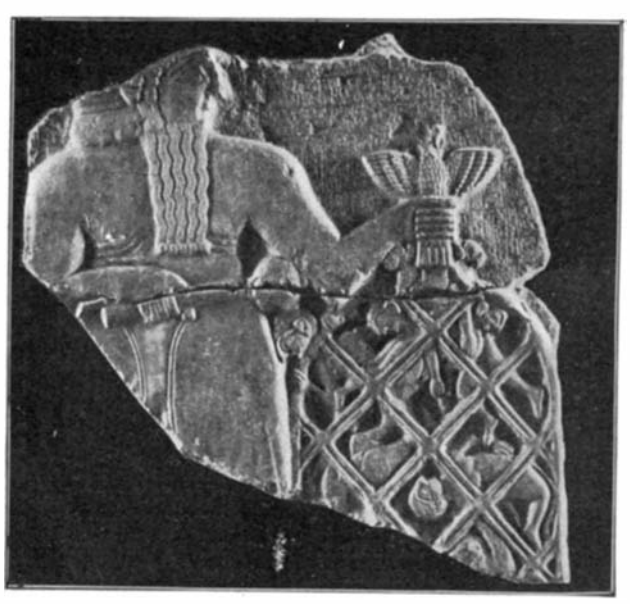
Spear Head of the Most Ancient Period.

Oldest Chaldean Sculpture and the Oldest Remains of Asiatic Civilization.



Two Fragments of Vulture Stele, Front Face. The Oldest Battle Scene in Existence.

Stele of Ur-Nina with Half-Finished Inscription. (About 4000 B. C.)



Fragment of Vulture Stele of King Eannadou. (About 4000 B. C.) Rear Face.

ANCIENT CHALDEAN REMAINS FOUND IN RECENT EXCAVATIONS.

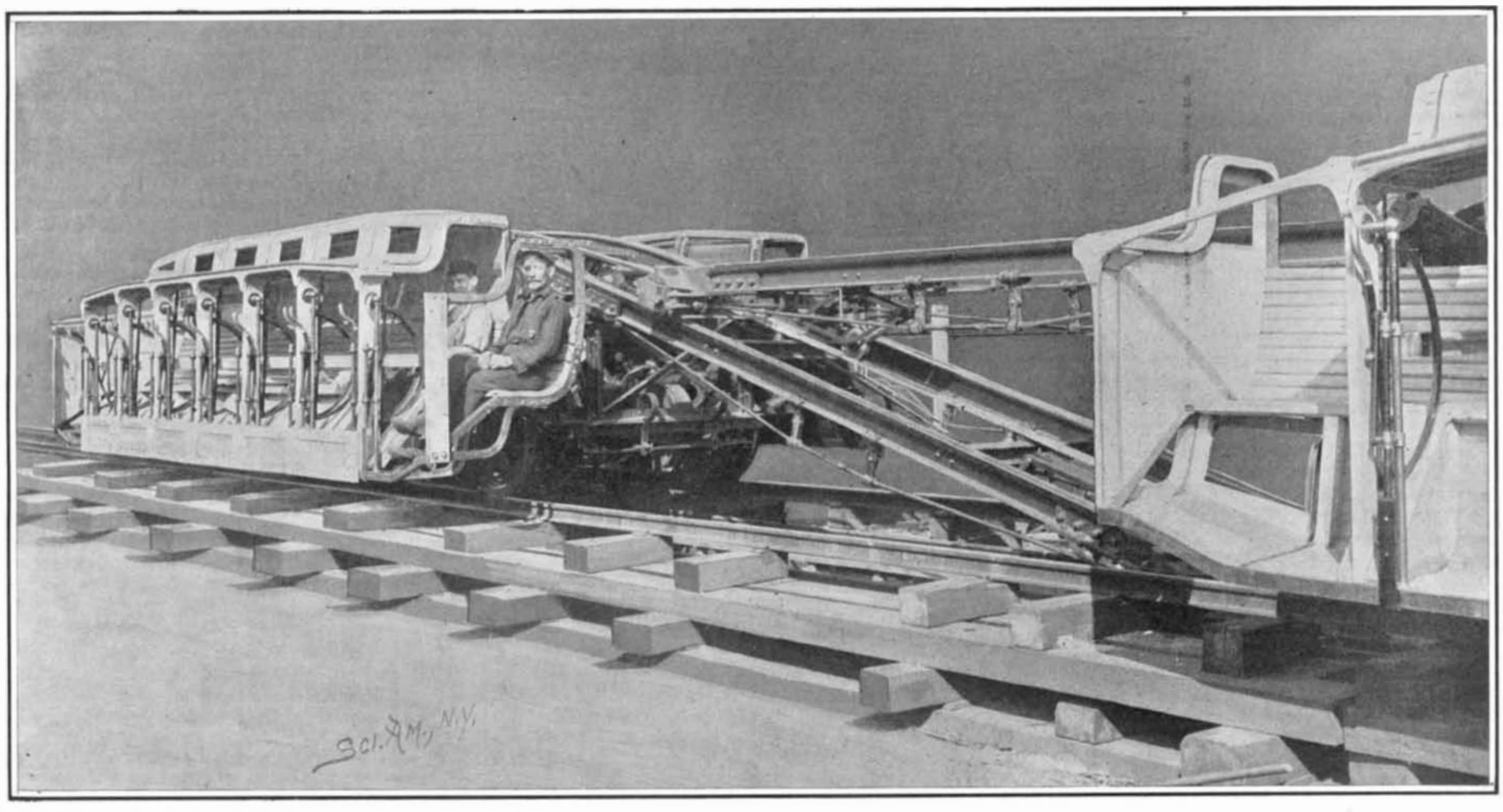
a rampart with their great shields. They have battle-axes as well as spears, and two bronze ax-heads of similar form were also found by M. Sarzec, together with the long spear-head which is shown in one of the engravings. This spear-head is also of bronze, and is over two feet long. One feature to be noticed is that all the warriors as well as the king maneuver their spears by holding them almost by the end and pushing them toward the front. The king, who holds spear strikes him in the forehead between the eyes.

In another place a cow is shown lying on its back and attached to two stakes as if for sacrifice. The four different scenes of the Vulture stele form four distinct bands of figures, and there were no doubt other bands which are now missing. The first rank, therefore, shows Eannadou with his heavily-armed infantry gaining the victory over the enemy. In the second band, the king is seen on his chariot at the head of

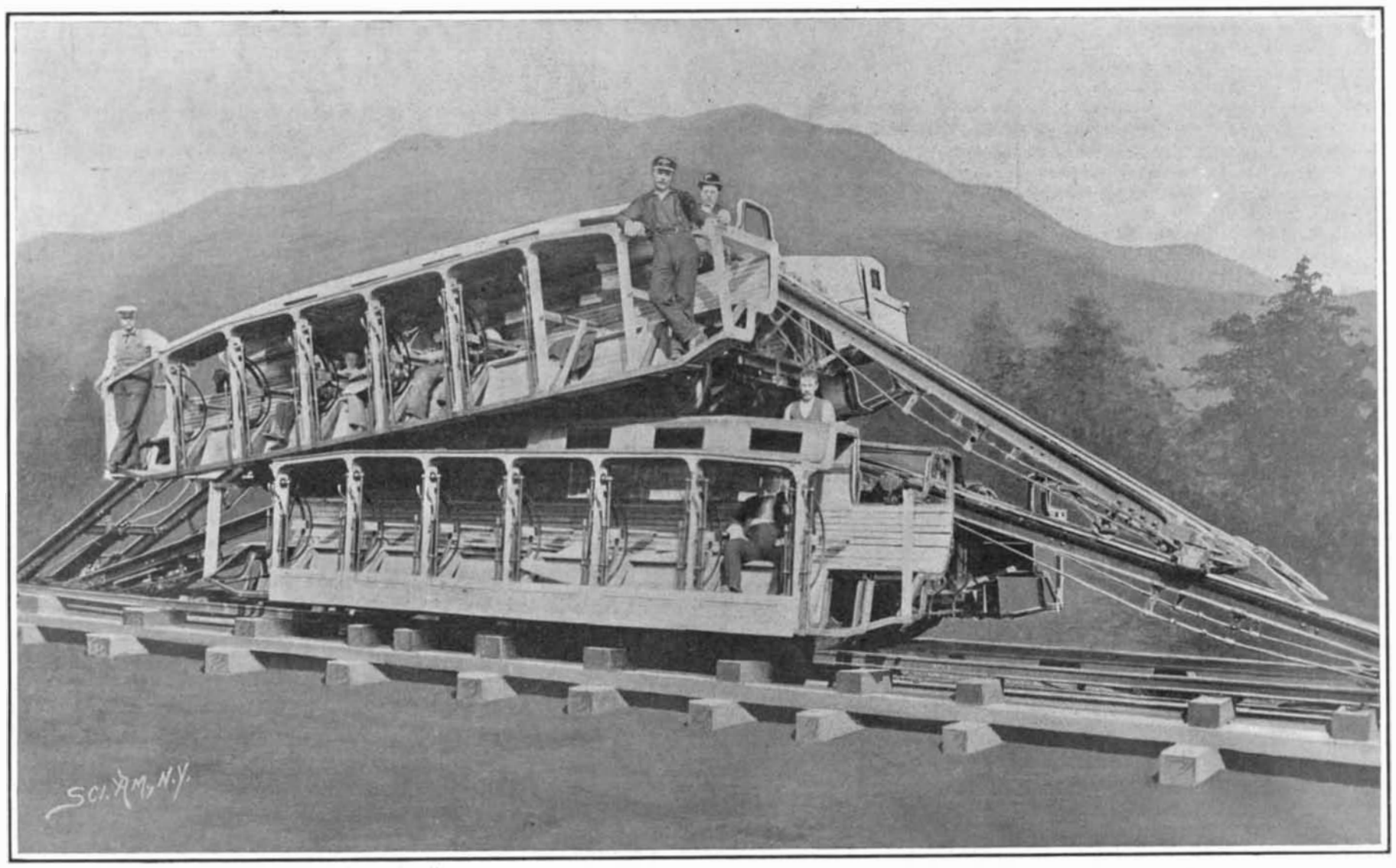
The other side of the stele is of equal interest. It presents a different class of figures from the front. One of the fragments shows two curious heads of war-goddesses with a two-horned head-dress crowned with feathers.

THE "LEAP-FROG" RAILWAY.

Something new has been added to the list of attractions at Coney Island. To the regular visitor of the



The Pilot Guiding the Superimposed Car up the Incline.



The Over-Riding Car About to Descend to the Normal Roadway.

THE "LEAP-FROG" RAILWAY.

a weapon in either hand, may be ambidextrous, like Homer's hero. One of the fragments shows the king, who is brandishing his spear and directing it toward a group of the vanquished enemy with shaven heads, whose chief turns back and holds out his left hand as if to implore mercy. But the point of the

the light troops and is pursuing the flying enemy. In the third range he celebrates his victory by a sacrifice which is associated with a funeral scene. Fourth, he immolates the prisoners and he himself immolates a vanquished chief. This is no doubt the oldest battle scene which we possess.

city's great playground, this statement in itself is remarkable. Each year, with the approach of summer, the appearance of new and much-heralded wonders leads us to think that human ingenuity in designing the startling amusement devices that stir the jaded emotions of the great East Side has about reach-

ed its limit. It is with astonishment mingled with admiration that we see the modern showman branch out successfully into the various departments of science and engineering, seeking for novelties. The day of cheap, catch-penny shows is rapidly passing; and as the quality of the entertainments becomes better, so does the taste of the general public attain a higher plane, and consequently, we find among the amusement devices, mechanical appliances and constructions that display great engineering skill and intelligence and thorough knowledge of physical laws.

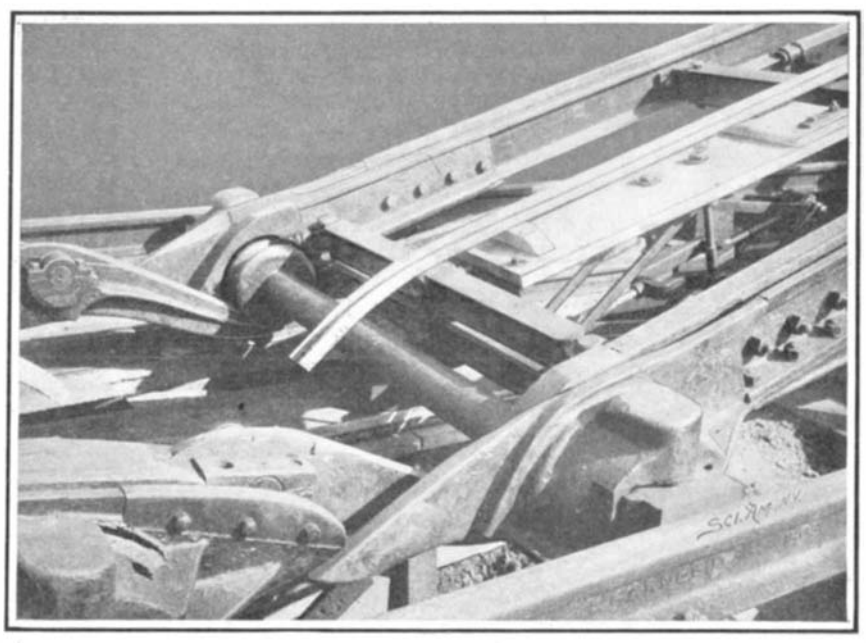
The latest and newest of these is the "Leap-Frog" Railway, illustrated in the accompanying engravings. Its name describes exactly what this remarkable railway does. Two electric cars, each carrying 32 to 40 comfortably-seated passengers, meet in a head-on collision while traveling along a single track. Instead of the smash-up, with its consequent horror of torn and mangled beings that would ordinarily ensue, one of these cars easily and gracefully glides up a set of curved rails with which the roof of the other car is provided, passes over it, and slides down to the track beyond. Mr. Philip K. Stern, an engineer of New York city, invented, designed, and personally superintended the construction of the "Leap-Frog" Railway. Strictly speaking, the device is not absolutely new, and many of our readers are familiar with the idea, as it was described and illustrated by photographs from Mr. Stern's working models, in the Scientific American of a year or two ago. This, however, is the first time that the invention has been put into practical use for amusement purposes, and successful tests have demonstrated its feasibility with this object in view.

The "Leap-Frog" Railway, which will probably be open to the public in July, is located in Dreamland Park, on a pier running out into the ocean for a distance of about 500 feet. There are two tracks, which allow the use of four cars. At the shore end, the pier is about 50 feet wide, with platforms and shelters for the passengers, bandstand, ticket-booth, etc. Beyond the platforms the tracks curve inward, and the pier narrows to a width of about 30 feet.

As will be easily understood, the crucial point in the design was the devising of the apparatus to lift the superimposed track of the one car, and to guide that car onto the superimposed track of the other car. It was imperative that this action should take place without jar or pounding, as the great weight of the cars would make the hammering very wearing, if not dangerous. Mr. Stern ingeniously obviates this difficulty by having two sets of wheels to each car, one set of narrower gage placed between and slightly lower than the other set, and correspondingly, four rails to each track. Only one set of wheels of the over-riding car is in use while it is moving over the other car. The superimposed track or overswitch, with the surface of the roadway, virtually forms a large vertical switch, analogous to the ordinary railroad side-turnout. It is in three sections, which are joined by hinge connections at each end of the upper part of the car. One of the outside sections is the so-called "pilot," the other the "skid." As the cars come together, two steel switch-tongues at the ends of the pilot rails slide underneath two small double-flanged wheels at the end of the skid rails of the other car, and lift the latter rails. The above-mentioned wheels are located inside of the small wheels at the ends of the incline sections, which keep these upon the rails and support the over-riding car. By using two sets of wheels and employing but one of these for the over-switching, the action becomes a smooth, rolling lift, obviating all jar and concussion. The superimposed track consists entirely of 82-pound rails, the heads provided with grooves, similar to the standard-type, curve guard rails in use on street railways. The wheels of the over-switching set are correspondingly provided with central, circumferential flanges, which travel in these grooves for the obvious reason that the over-riding car may descend from its elevated position in no manner other than that intended by the inventor. It was necessary that the pilots and skids should possess sufficient rigidity to keep the rails always in their proper relative positions, with their vertical planes parallel, but still have enough play to allow for all possible irregularities in the track or distortion due to unequal loading. The inventor, for this purpose, designed a special system of universal jointing, which permits of lateral movement of the pilots and skids in rounding curves, a vertical rotary movement allowing the upward and downward swing of the over-switching system when the over-riding car is traversing the subjugated car, and an independent movement of each of the rails comprising the over-switching system in approximately a vertical plane, while at the same time any gyration of these members is restrained. During these movements the gage of the track formed by these members is maintained by a system of steel ties, which are secured to the rails by the universal jointing system referred to.

The framework of the car which bears the over-switch track is built according to a well-known system of bridge construction. The limited space at our disposal makes it impossible to describe this construction, but we may say here, that it is efficient, rigid, and comparatively light. That great strength is necessary can be seen from the fact that each car, without motors, weighs 28,000 pounds. The steel framework is carried by lateral bridge trusses, and the whole structure, comprising car-bodies, trucks, and over-turnout track, is elastically mounted on the journal boxes by means of differential springs. The axles are 4 inches in diameter, except at the journals, where this dimension is increased to 5 inches. The journal boxes, which are of special design, are placed between each two wheels of the two different sets. The wheel base is 15 feet, the length over all, from pilot to skid, about 49 feet. The wheel base was so designed that the weight of the superimposed car is never completely on the skid or pilot rails.

The motive power is furnished by two 30-horse-power General Electric motors to each car. Five hundred and fifty-volt, direct current is used, about 250 amperes being necessary to drive the car up the incline. The current is led to the motors by means of a channel rail between the track rails and a special grooved contact wheel. The contact is maintained throughout the travel of the car, the superimposed track being also provided with a third rail. The position for the operator is in the center of the framework under the over-



The Pilot Picking up the Skid Rails of the Over-Riding Car.

THE "LEAP-FROG" RAILWAY.

switch track. Here are located, besides seats for several passengers, an ordinary electric controller and a simple but powerful, link-suspension hand-brake. By means of this brake, which acts upon the inner set of wheels (for these are in action on the grades) the car can easily be stopped and held at any point of the incline, which has a maximum slope of 16 deg.

The passengers are carried in the car bodies, which are hung on each side of the framework, the seats, as shown by the illustration, facing outward. It was, of course, necessary that the cars be made as low as possible, in order to diminish the difficulty of over-switching. Consequently, the bodies were made just high enough to conveniently seat the passengers, and a simple system of hand levers raises the roof and lowers the footboard for the ingress and egress of the travelers. The shape of the body is such that the base of the superimposed car just clears the roof of the lower one. The altitude of the curve, the distance from the roadway rails to the over-switch rails, is just 6 feet 3 inches.

The cars will be brought together at a speed of about eight miles an hour. At first glance, it would appear that the cars would pass each other at a rate of speed just double this, but a moment's thought will show that this is an error. The inclined rails actually come into contact at this double rate of speed, but the instant the over-riding car passes onto the inclined rails, this ceases, and the rate at which the cars move by one another is the original eight miles per hour. It appears strange to see the over-riding car actually carried back in the opposite direction for a brief time, but this actually happens, the fact being due to the decrease in the speed of the travel while the car is moving up the incline, notwithstanding that a great part of the load is taken off the motors of the over-riding car, as during the superimposed position the track is also traveling in the direction of the rotation of the wheels.

Prizes for Essays on Lead Poisoning.

The Internationales Arbeitsamt, in Basel, Switzerland, has offered the following prizes for essays on means of combating lead poisoning:

1. A prize of 5,000 marks ($1,190) for the best essay upon the most practical method of eliminating the danger of lead poisoning during the process of handling lead ores.

2. A prize of 10,000 marks ($2,380) for the best essay upon the elimination of the danger of lead poisoning in lead-smelting works.

3. Two prizes, one of 2,500 marks ($595) and a second of 1,500 marks ($357), for the best essays upon the elimination of the danger of poisoning in chemical and electrical works where lead is in use.

4. Four prizes, one of 1,500 marks ($357), a second of 1,000 marks ($238), and two of 750 marks ($178.50) each, for the best essays upon the most practical method of avoiding lead poisoning in trades such as painting, enameling, etc.

5. Four prizes, one of 1,500 marks ($357), a second of 1,000 marks ($238), and two of 750 marks ($178.50) each, for the best essays upon the elimination of the danger of lead poisoning in factories where large quantities of lead are used, as, for instance, in type foundries, printing establishments, etc.

The essays must contain a systematic description of the source of lead poisoning, in which the mode of production is described and the dangers existing in each stage of the process, in transportation, etc., are mentioned. Other causes of lead poisoning are also to be given, as, for example, working too long at a certain process, uncleanliness, insufficient knowledge on the part of the workmen, bad or insufficient food, irrational mode of living, and unhealthy apartments.

The proposals made must give the possibility of elimination of the danger in such a manner that no objection can be made on technical, hygienic, or economic grounds. The dangers are to be given, so far as possible, in classes, in order to make it clear at what stage of the process or under what conditions there is greatest and least danger.

In proposals for new apparatus or alterations in process, the cost and saving involved in such proposals must be given. It is preferable that the essays contain proposals for improving the existing laws upon this subject in all states, and the alterations in legislation which would be necessary to carry out the proposals. They could also contain copies of proposed instructions to be posted in factories for the guidance of workmen. Works containing existing laws on this point can be found in most important public libraries.

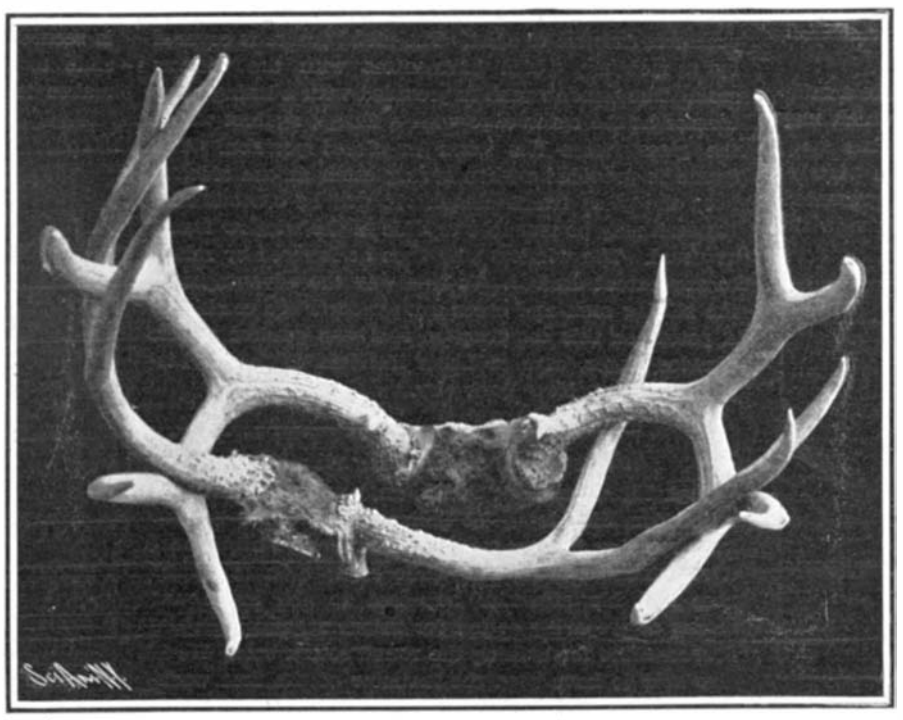
Papers may be written in English, French or German. Printed books will not be admitted. The completed manuscript must simply bear a title on the cover. The name of the author is to be inclosed in a sealed envelope which bears the title of the essay. The essays must reach the Internationales Arbeitsamt in Basel by December 31, 1905. The Internationales Arbeitsamt will have the right to publish the prize essays, although the author retains the right of literary ownership. Articles not published will be returned to the authors.

All communications must be addressed to "Das Internationales Arbeitsamt, Basel, Switzerland," and should be sent by registered mail.

A curious point in patent law was recently raised before Mr. Swinfen Eady in the English courts. In an infringement action, the defaulter was stated to have manufactured a patented article without the requisite license. The patent in question was for a wheel to be fitted in solid India rubber tires. In the invention it was possible to replace the tires when worn out, as they could be fitted into a groove in the iron or steel rim of the wheel. This the infringer had done, and claimed his right to do so, as he was merely repairing a patented article. The court held that "it is a question of fact in each case whether the work which has been done may be fairly termed a 'repair,' regard being had in each case to the exact nature of the invention. The purchaser of a patented article has a right to prolong its life by fair repair, but he has not any right to obtain, without license from the patentee, a substantially new article made in accordance with the invention, retaining only some subordinate part of the old article, so that it may be said that the combination is not entirely new. Such a retention of an old part would be colorable only, and would prevent the article from being substantially a repair of the old one."

TWO PAIRS OF INTERLOCKED DEER HORNS.

These remarkable pairs of interlocked antlers were found by Wade Snyder, who was hunting near Lakeview, Oregon. He presented them to the firm of Whorton & Smith, who had them mounted on a board ornamented with a decorative design, in which the letters W S appear. It seemed from the condition of the carcasses when found, that the deer had not been dead many weeks. The antlers are fine specimens, one set belonging to a deer three years old, and the other to a deer a year older. They are so closely locked, that it is impossible to force them apart without breaking them. The deer must have made frantic efforts to get free before they gave up the struggle and died.



A PAIR OF INTERLOCKED DEER HORNS.

FOLDING CANOES AND JOINTED OARS.

BY EMILE GUARINI.

The last exposition of bicycles and automobiles at Brussels was characterized by numerous exhibits that well showed how great is the progress that has recently been made in the domain of automobilism, properly so called; that is to say, of vehicles with mechanical motors, as well as in the domain of other methods of transportation. In the latter domain, among the other things exhibited, a folding canoe and a jointed oar that permitted of a multiplication of the power and steering of the boat attracted much attention. These were exhibited by the firm of Denis, Doyen & Co., of Brussels.

The canoe is distinguished by its great simplicity. It comprises but two parts, a wooden frame, and sides and ends of impermeable canvas. The frame, which is very light, although very strong, is formed of a combination of jointed levers, that open and close like an accordeon. The impermeable canvas is provided in the interior and on each side with four gussets of thick leather in which are inserted the bearing points of the framework, the result of which is to increase the resistance of the canvas at these places, and consequently to prevent any tearing. The canvas and framework are fixed to each other by strong straps. A floor in three parts, resting upon the cross-pieces that connect the levers, forms the bottom of the canoe designed to support the weight of the occupants or baggage, without any direct stress upon the canvas. The seats, which are of cane, are suspended from the levers, and the oars are dismountable at will. This canoe, which is perfectly tight, is, despite its minimum weight, perfectly stable. It can be put together or taken apart in five minutes. In order to take it apart, all that has to be done is to detach the straps, remove the canvas, floor and oars, spread out the canvas, open and fix the frame and place it in the canvas, pass the straps around the cross-pieces of the front and rear corresponding to the frame, put the front board of the bottom of the canoe, then the rear one, and then the center one upon the other parts, and finally dismount the oars and place them on the top of all.

The canoe can always be carried on the back of a man, whatever be its type. That for one person can be carried like a valise. It is propelled by a paddle and can be steered without any trouble owing to its lightness and its slight draft. It can be used in water so shoal that no other canoe could be employed therein. The canoe for two persons is adapted more particularly for fishing and duck shooting. Owing to its low form, its dark color, and its silent progress, it permits of approaching the game very closely. With this canoe the fisherman, after selecting a favorable place, can preserve his position therein as long as he choses. Should he have "fisherman's luck," he can take his canoe out of water, fold it up, and carry it to any other stream, deemed more favorable. By placing two of these canoes side by side and lashing them together with straps, extreme stability may be obtained.

Another type is specially designed for pleasure excursions, and is adapted for the use of those living near a river or lake. Finally, still another type is designed for army use, for explorers, etc. This is formed of two parts, and has a prow in front, and a square-cut stern. These two parts are joined end to end by means of a cross-piece the arrangement of which permits of the immediate junction or separation thereof. After the junction has been effected, the canoe forms a unit with a tight joint in the center. Each part is so arranged that it can be instantly united with several others so as to form a footbridge.

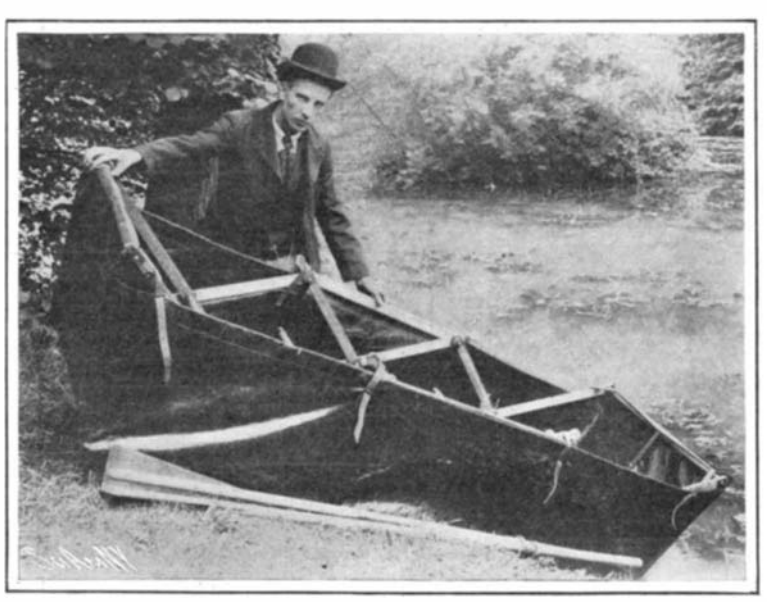
The seats of each part are arranged for three persons each and two oars, or six persons and four oars for each canoe.

The canoe for one person is 7¼ feet in length, 25 inches in width, and 13 in depth. It weighs 44 pounds, draws 8 inches of water, and is capable of carrying a load of 500 pounds. The canoe for two persons is 7¼ feet in length, 30 inches in width, 20 inches in depth, draws 8 inches of water, weighs 48 pounds, and carries a load of 770 pounds. The canoe with a prow, for two persons, is 9 feet in length, 30 inches in width, 21 inches in depth, weighs 52 pounds, and carries a load of 835 pounds. The type for three persons is 10 feet in length, 36 inches in width, and 20 inches in depth, weighs 46 pounds, and carries a load of 1,180 pounds. Finally, the type for six persons is 11.8 feet in length, 36 inches in width, and 21 inches in depth.

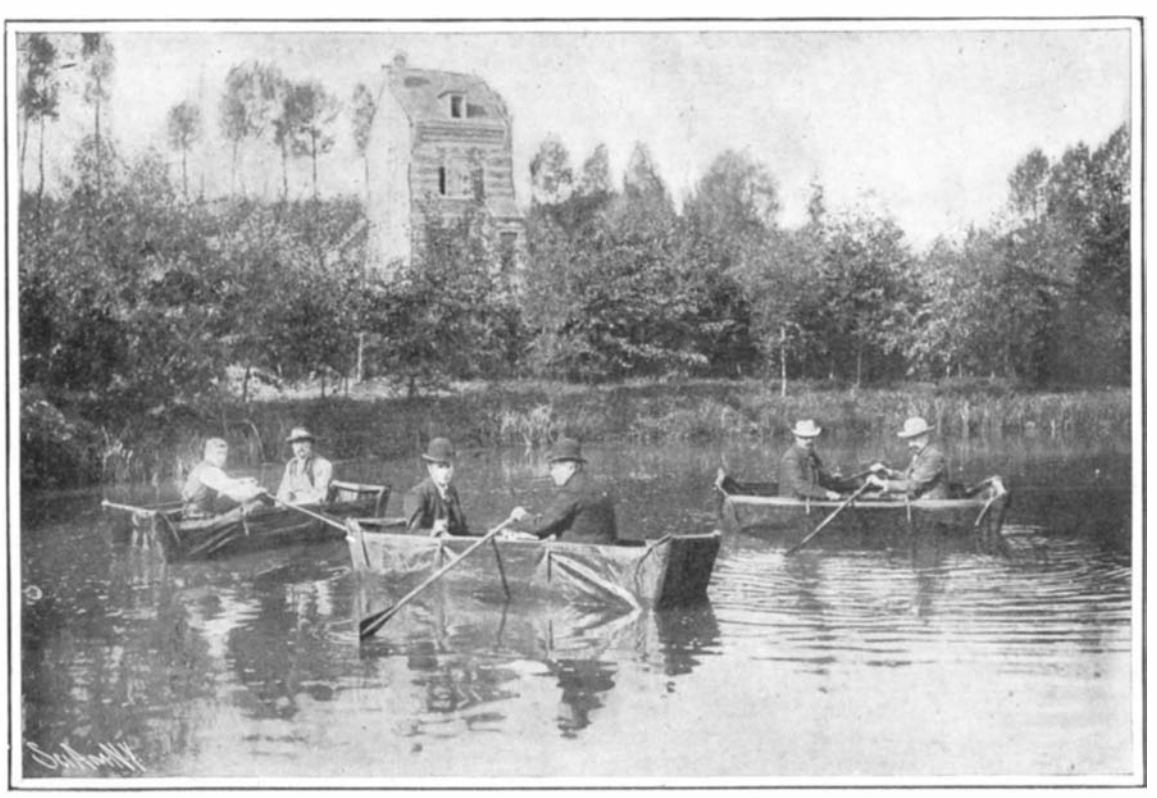
The oar is made in two parts connected by a joint placed at the support of the rowlock. At each part of the oar there is fixed a toothed sector. These sectors mesh with each other and act upon two plates provided with axes around which the sectors revolve. Each of the sectors is provided with a round bush, in one of which the handle of the oar is fitted and in the other the part that dips in the water.

The plates that connect the two parts of the oars are fitted to the support of the rowlocks, which are so fixed to the canoe that it is possible to row with the jointed oars in the same way as with ordinary oars. Through the arrangement of the sectors, it is possible to obtain with the jointed oar a greater amplitude of motions than with a common one of the same length. Since the diameter of the sectors can be varied, it is possible to obtain a multiplication of power, and, consequently, a diminution in the pull necessary for the propulsion of the canoe; and this is a very important consideration. It is possible to make use of ordinary oars, all that is necessary in order to do this being to adjust them in the bushes of the sectors. The apparatus is provided with a support which is screwed to the upper edge of the canoe.

Carrying the Boat.



Launching the Portable, Collapsible Boat



The Portable Boat Afloat.

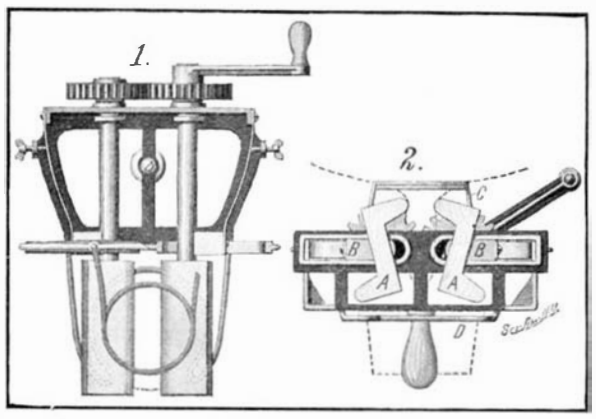
FOLDING CANOES AND JOINTED OARS.

In America the so-called problems of agriculture have been largely those of the mere conquest of land. They are the result of migration, and of the phenomenal development of sister industries. They have resulted from a growing, developing country. They have been largely physical, mechanical, transportational, extraneous—the problems of the engineer and inventor rather than the farmer. The problem has not been to make two blades of grass grow where only one grew before, but how economically to harvest and transport the one blade that has grown.

Patent Department

A SIMPLE MILKING MACHINE.

In the accompanying engraving we illustrate a milking machine of exceedingly simple design, which may be quickly assembled for use, and readily taken apart for renewal or repair. Fig. 1 shows a plan view of the machine, while in Fig. 2 a side view is presented, illustrating the method of operation. In this view the

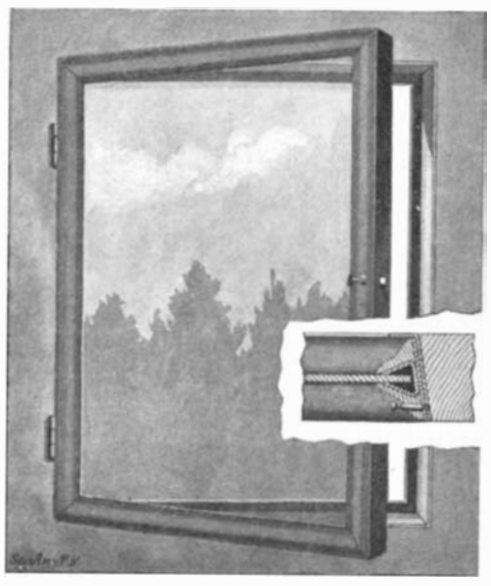


A SIMPLE MILKING MACHINE.

udder and one of the teats are indicated by dotted lines. It will be observed that milking is done by a pair of blocks, *A*, which are practically Z-shaped in cross-section. By reference to Fig. 1, it will be seen that these blocks are mounted on a pair of shafts, which are geared together at one end and provided with a crank handle, by which they may be rotated. The shafts are mounted to swing laterally in a slot in the frame just back of the blocks, but are normally pressed inward or toward each other by a pair of leaf springs provided with head pieces, *B*, which bear against the shafts. A ring of spring wire, *C*, extends above the milking blocks, and below them is a wire frame, *D*, adapted to support a milk pan or pail, as shown in dotted lines. In use the machine is held by the handle shown at the bottom of Fig. 2, and the guide ring, *C*, is slipped over one of the teats. The latter will then project between the milking blocks, and when the crank is turned, the blocks will revolve, exerting the necessary downward squeezing pressure to draw the milk from the udder. The spring pieces, *B*, permit the milking blocks to spread apart to any required distance to properly receive the teat between them, and the spring wire guide, *C*, presses upward against the udder, and thus assists in causing the discharge of milk therefrom. A patent on this milking machine has been granted to Mr. Young Stothard, of Indianola, Neb.

GLASS-FRAMING ATTACHMENT FOR WINDOW SASHES.

Windows as ordinarily constructed are difficult to clean without exposing the operator to danger. Furthermore, the usual sliding sash construction does not permit of opening more than one-half of the window at a time, so that it is impossible to get the complete ventilation afforded by the old casement windows. A recent invention is herewith illustrated, which in a very simple manner overcomes the above-mentioned



GLASS-FRAMING ATTACHMENT FOR WINDOW SASHES.

defects. The glass is mounted in a frame, which is hinged to the window sash in such a manner that it can be swung into the room, while the sash remains in position in the window frame. This enables both sides of the glass to be cleaned without the slightest danger to the operator, and when the glass is swung open for ventilation purposes, it will be evident that the entire window frame is uncovered. The glass-carrying frame is preferably made of light steel strips, as indicated in the section view. In this manner a very strong construction is provided, which is at the same time very light, and does not obstruct an appreciable amount of light. The metal frame is covered by a molding, which harmonizes with the window sash. The window sash is provided with a lining plate formed at the outer edge with a flange, against which the glass frame lies when in closed position. The frame is provided with a spring catch at one side, to keep the glass frame closed. It will be obvious that the sash may be mounted to slide in the window frame as usual. The window may thus be lowered or raised to any extent desired. In this way the advantages of the sliding sash and casement windows are combined. A patent on this construction has been granted to Mr. Charles Yager, care of Louis Baerlein & Co., 56 Lispenard Street, New York city.

Brief Notes Concerning Patents.

Capt. Hamilton Ezra Smith, an inventor of national reputation, died lately at Salina, Kan., where he had been residing for two years. He was once a Missouri River steamboatman, and while engaged in this business had his attention attracted to the indifferent means of preparing cotton for shipment, and built the first machine for making the round cotton bale. He is also said to have been the inventor of the first washing machine, which was responsible for his giving this branch of the machine business considerable attention, and resulted in the invention by him of a number of pieces of laundry machinery, which are to be found at the present time in all the larger laundries of this country. At one time, while residing in New York, he figured in reform politics, and took an active part in the fight against the ring rule of "Boss" Tweed. Later in his life he resided in Philadelphia, where his wife died six years ago, and his body was shipped to that city for interment beside that of his life partner.

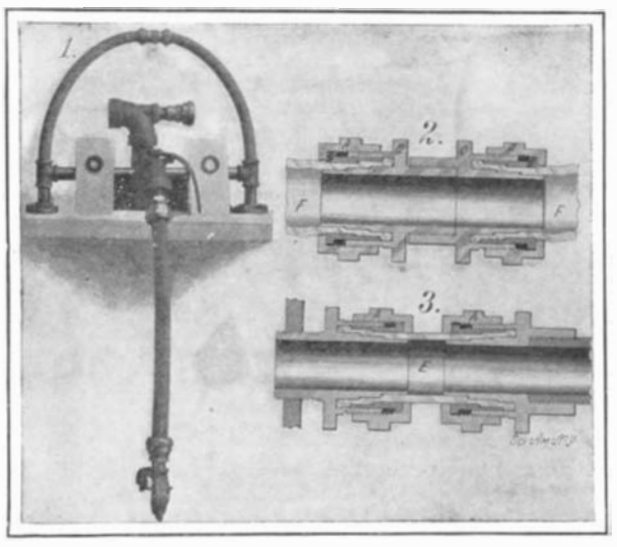
A great improvement in the manufacture of pins has recently been made in the machine devised by C. J. Brosnan, of Springfield, Mass. The features of the machine are not yet divulged by the inventor, but he says that by its use it will be possible to point and head three hundred pins a minute in a manner far superior to any of the American machines at present. The best machine at present in use is said to have a capacity of about sixty pins per minute. An auxiliary machine will put these pins in papers at the rate of thirty at one operation, which is very much faster than the present process. The best pins sold in this country are from an English factory, which seems to control the manufacturing machinery, but Mr. Brosnan claims that with his invention, the American end of the industry will soon outstrip the English in quantity and quality.

A NOVEL WAVE MOTOR.

A wave motor of novel design has recently been invented by Mr. Juan L. Ariztia, of Iquique, Chile. This motor is arranged to be operated by both the vertical and the lateral movements of the waves, thus utilizing every motion of the water. It comprises a rigid frame, which supports a platform overhanging the water. On this platform a number of cylinders are mounted, each with a piston connected to one of two rocking frames below. Each piston rod is formed of sections connected by ball-and-socket joints. One of the rocking frames is pivoted to the main or rigid frame of the wave motor, and the other rocking frame is pivoted within this first rocking frame, but with its axis at right angles thereto. The inner rocking frame is thus afforded a universal motion. To the inner frame a pendulum rod is attached, which carries at its lower end a large float immersed in the water. The waves act to sway the float, thus rocking the frames with which it is connected, and these in turn operate the pistons with which they are connected. The universal joints on the piston rods permit the same to yield to lateral motion, and to transmit only vertical motion to the pistons. In addition to the main float an auxiliary one is provided, which is adapted to slide freely up and down on the pendulum rod. Universally-jointed connections are provided between this float and a set of pistons on the platform. Only one such piston and connection are here shown, though it is obvious that a number might be used. The auxiliary float makes use of the vertical motion of the waves, and will be operated by the ground swell when the surface of the sea is comparatively calm. The apparatus acts as a third-class lever transmitting power direct to the pistons or pumps. The power may be regulated by lengthening or shortening the pendulum rod.

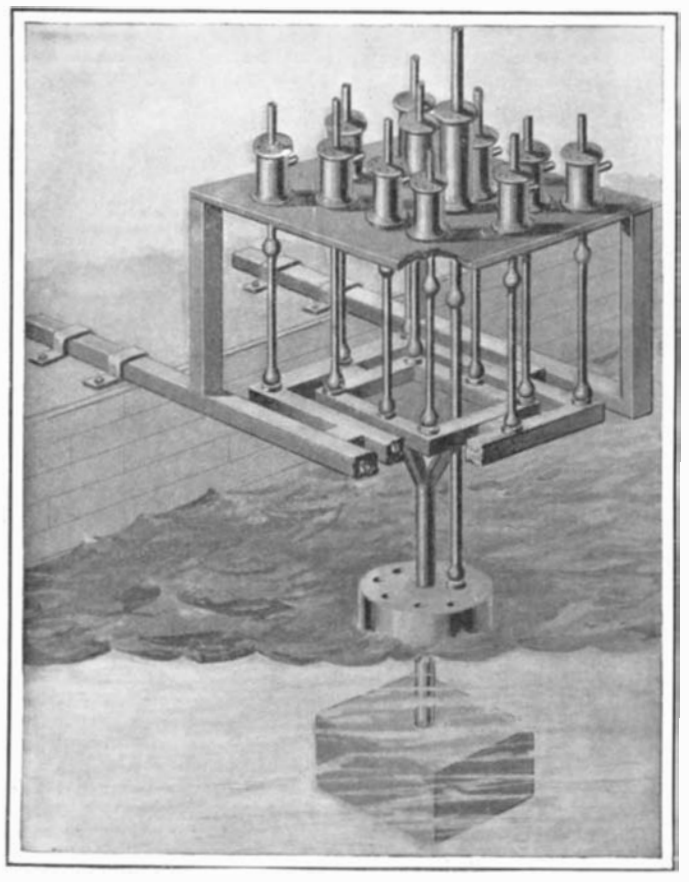
A CONVENIENT PIPE COUPLING.

In nine cases out of ten, when an air hose bursts, it will burst at the end of the nipple, on which the hose is secured with iron band and bolt. Now, it is impossible to remove the hose without cutting it, which makes it too short for further use, but even if long



A CONVENIENT PIPE COUPLING.

enough there is no way of reconnecting it. In the accompanying illustration we show a new type of hose coupling, calculated to overcome these objections. If the hose bursts at the nipple, it can be removed quickly, and after cutting off a short piece it can be reconnected. The two section views of our illustration show the device as applied in one case to coupling two flexible hose sections, and in the other to connecting a lead-pipe section with an iron pipe. In each case the coupling members used are identical, and are varied only in their relative positions. These members consist of two cover sleeves, *A*, two wedge sleeves, *B*, and two clamping members, *C*. Each clamping member is formed with two concentric tubular extensions, between which the hose, *F*, is fitted. The wedge sleeve, *B*, is then forced in between the extensions over the hose, and firmly wedged in place by the cover sleeve, *A*, which bears against the end of sleeve, *B*, and is threaded onto the outer extension of the clamping member. The face of the inner tubular extension and that of the wedge sleeve, *B*, are stepped so as to insure a firm grip on the hose, *F*. One clamping member is formed with a threaded tubular shank, and the other with a correspondingly threaded socket, so that when these members have been respectively attached to the hose sections, they can be screwed together to couple the hose. In Fig. 3 the coupling members are reversed, and the illustration shows the tubular shank threaded into an iron pipe, while the socket receives another pipe. The coupling members are clamped to opposite ends of a section of lead pipe. Mr. Alfred Higginbotham, of Lock No. 4, Washington County, Pennsylvania, is the inventor of this improved coupling.



A NOVEL WAVE MOTOR.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC SYSTEM.—A. L. SJOBERG, Union Hill, N. J. Novel means are comprised in this invention whereby any one of a series of stations may be selected from a central station and a local circuit closed or mechanism moved for the purpose of transmitting power or energy, or instead of closing the local circuit the current from the main line can be diverted to the local circuit selected. These local circuits may be used for ringing bells or giving any kind of signal, operating motors or electric lights, telegraphing, telephoning, etc.

Of Interest to Farmers.

BEET WEIGHING AND DELIVERING APPARATUS.—J. S. EASH, Niwot, Col. The more especial design of this apparatus is for its use along railroad-tracks in the country or in towns and cities and arrangement to permit convenient driving of a loaded vehicle onto a weighing platform, to then dump the contents of the vehicle, and finally elevate the contents into a car on the railroad-track.

SHOCK OR GRAIN LOADER.—W. B. PENROSE, Anthony, Kan. This apparatus gathers shocks or sheaves of grain in the field and transfers them to a wagon or other vehicle moving alongside of the loader. The inventor's principal object is to provide a light and easily-operated loader which may be driven and controlled by one man and which will effectively gather sheaves or shocks of grain from the ground, elevate them to the necessary height, and deposit them in a wagon or other vehicle moving at one side of the loader.

WEEDER.—N. MCEACHERN, Walla Walla, Wash. This invention is an improvement in weeders, and the inventor employs cutters or blades arranged in form of a V, and diverging rearwardly. The uprights or standards of the knives are adjusted by special arrangement of bolts engaging a frame, and the said uprights rise at the front of the knives so as to pass through the bushy tops of the weeds before the latter are cut off under the surface of the ground by the blades, this arrangement having the object to prevent clogging of the weeds around the uprights.

SICKLE-BAR.—W. H. BRUSMAN and O. F. BRUSMAN, Elkhart, Ind. This invention refers to sickle or cutter bars for mowing-machines; and its object is to provide a bar which is simple and durable in construction and arranged to detachably hold the individual knives in place thereon without fastening them with screws, bolts, or rivets, as is ordinarily the case, and at the same time to allow for expansion and contraction.

Of General Interest.

COLLAR-SUPPORTER.—J. W. TROXELL, Breckenridge, Ill. The invention relates to supports for collars, and one of the principal objects is the provision of a convenient and effective device of this character. In use the collar being turned up, means are provided by which the eyes, nose, and mouth are left free, while the neck, ears, and the greater part of the face are effectively protected. The supporting device may be readily withdrawn and the collar turned down into its normal position.

LUBRICATOR.—F. G. SWIFT, Elmira, N. Y. This improvement refers particularly to a novel means for straining oil as it enters the reservoir of the lubricator, this means being readily removable to permit cleansing the parts. A closure having an exteriorly-threaded flange may be removed at will, carrying with it a ring and strainer, thus greatly simplifying the construction of the device and increasing the ease with which it may be handled.

SIPHON.—P. MCGRATH, Hibbing, Minn. This invention is designed as an improvement on a former patent granted to Mr. McGrath, and has for its object to provide an efficient device for withdrawing liquids from a vessel having no faucet nor other outlet. All parts may be easily detached and cleaned, and by means of a grooved screw-plug in the upper end of the plunger-head the discharge-nozzle can be readily put on and taken off.

RULE.—J. E. WILSON, Lancaster, Pa. In the present instance the improvement has reference to a rule; and the objects of the invention are the provision of means for calculating distances and angles. The rule is capable of general use; but it is especially applicable for building purposes.

BOOK-FINISHER'S STAND.—V. KLING, Council Bluffs, Iowa. The inventor provides a stand of novel construction on which a large book may be placed for finishing the sides and turned as desired, making it unnecessary for the workman to handle the book excepting to turn it over to finish the opposite sides, thus relieving the finisher of considerable hard work and consequent loss of time.

TOY.—F. GARRECHT, Idaho City, Idaho. In this class of toy an object is loosely held on a support and receives a rocking movement on said support from the joint action of gravity and the peculiar form of the support, and the inventor has for his object to provide a toy having novel details of construction which are quite amusing, two grotesque figures receiving twirling and rocking movements as they descend from an elevation.

GLOVE.—A. H. FISHER, Hardy, Neb. The present invention has reference to gloves and glove making, the object being to produce a glove of an improved pattern, especially adapted for use as a workman's glove. One of the objects has been to produce a glove which is reversible, so that it may be worn by either hand, and the pattern is designed with a view to produce a substantial fit though the glove be applied to either hand.

WINDING-HANDLE FOR TAPE-MEASURES.—J. G. EDDY, New York, N. Y. In the present patent the invention has reference to tape-measures and admits of general use, but it is of peculiar value in connection with tape-measures of the kind rolled into a coil and adapted to be wound and unwound at will.

UMBRELLA.—G. ERICSON, New York, N. Y. The device forms a strong light umbrella which may be extended and used in the usual manner. When the parts are folded, they are contracted in length approximately one-fifth of the normal length of the umbrella, so that the umbrella may be conveniently packed in a satchel or carried or stored in any other desired manner. It is capable of being manipulated quickly and easily.

HARNESS-SUPPORT. — R. L. NEWELL, Keithsburg, Ill. The support is especially useful in its connection where the pulling force is exerted intermittently, such as in the raising of ice, stacking of hay, scraping, plowing, etc. The object here is to provide an arrangement for supporting the rear portion of the harness, especially the swingletree and traces, when the pulling force is not being exerted in order to prevent the swingletree and its contiguous parts from striking against the horses' rear limbs or the ground.

INSTRUMENT FOR WATCHMAKERS' USE.—C. M. THOMSEN, Minneapolis, Minn. In this case the object is to provide a novel simple instrument in the form of specially-constructed tweezers, which may be very conveniently and effectively used for holding firmly the collet of a hair-spring, so that a reamer or broach may be inserted through the hole in the collet and rotated for an enlargement of the hole to a proper size for an exact engagement with the staff whereon the hair-spring is to be mounted.

AMMONIA-STILL.—H. A. ABENDROTH, Berlin, Germany. This still comprises superimposed cells having inlets and outlets for ammonia-water, the bottoms of the cells being constructed to form declining sections, and each section being constructed of terraces declining from the point of inflow to the point of outflow of the water, said terraces, with the exception of the highest and lowest of them, being provided with steam-inlet pipes having hoods.

MEASURING VESSEL.—F. ALBO, Pueblo, Col. In the present patent the improvement has reference to a device for measuring and delivering liquids, and the principal object of the invention is the provision of a vessel which may be filled or partially filled with a liquid and from which a known quantity or a succession of known quantities may be delivered.

RAZOR.—W. R. CHRISTIE, New York, N. Y. The purpose of the improvement is to provide a razor of the ordinary type which is furnished with an exceedingly thin removable blade and to so construct the razor that the blade can be quickly and conveniently introduced in its holder and securely fastened to place, the blade when not needed being inclosed in the handle in the customary manner.

PANORAMIC ATTACHMENT FOR PHOTOGRAPHIC CAMERAS.—H. R. KIESSIG, Sacramento, Cal. The object of this inventor is to provide a device that may be readily attached to the ordinary forms of detachable-back cameras and with which the scope or composition of the picture may be predetermined, the device being so arranged as to permit exposures for ordinary pictures when desired.

APPARATUS FOR PRODUCING PURIFIED WATER.—G. KNODLER, New York, N. Y. The object in this instance is to provide an apparatus for producing purified water for drinking and other purposes and arranged to sterilize, evaporate, and condense the water and to sterilize and wash the air used for aerating the sterilized condensed water to insure a product of an exceedingly wholesome nature.

WATER-FORCING APPARATUS.—M. A. LIBBEY, South Berwick, Maine. The device is intended particularly for use as a fire-extinguishing apparatus or for irrigating gardens, and the like. The invention involves certain novel features of construction and arrangement of parts which enable the apparatus to be operated readily and quickly to throw a considerable stream of water in any direction desired, and in the form of a solid jet or open spray.

CONNECTING DEVICE.—A. B. MANCHESTER, Findlay, Ohio. Mr. Manchester's invention has reference to devices for connecting various elements, being particularly adapted for use in connection with the pumping powers of oil-wells and the like. His principal objects are the provision of a simple and strong device of this class which may be readily disconnected.

LADDER.—E. A. MEACHAM, Riverside, Cal. The invention relates particularly to improvements in means for securing steps to the side rails of ladders, cellar-stairs, or the like, an object being to provide a simple means for securing the steps without mortising the steps into the rails, so as to weaken the rails, a further object being to so construct the fastenings that they will not only add to the strength of the steps and rails, but will stiffen the whole structure.

TIMBER PRESERVATIVE.—R. P. REYNOLDS, Walla Walla, Wash. The object in this case is to provide a coating for rendering timber proof against decay when used above or under ground. The ingredients are thoroughly boiled in a cauldron or vat for about ten minutes after boiling-point is reached, and then the timber is immersed for, say, about five minutes in the boiling mass to form a coating. The coated timber is then removed and the coating allowed to dry and harden before using the timber.

THEATER-CHAIR.—E. H. WIERSCHING and C. J. BERGSTROM, Binghamton, N. Y. The purpose of the invention is to provide a special construction of theater and similar chairs wherein the seats will be normally held close to the backs of the chairs by means of suitable tension devices, the seats being held in a horizontal position only when occupied, the controlling factors of the seats being such that they will automatically raise the seats when the latter are vacated. This application is a division of the application made by the inventors for an improvement in theater-chairs formerly filed and allowed.

TURPENTINE-BOX.—A. C. MCLEOD, Quitman, Ga. By this invention a considerable range of adjustment is provided, so that the box can be applied to trees of different diameters, and when the tree has been hacked and the box applied and all of the sap has been withdrawn from the particular hacks the box can be moved upwardly as the hacking of the tree proceeds, so as to secure practically the entire output. The box may be used for gathering the sap of maple trees or other analogous use.

BURIAL-VAULT.—R. F. FOLK, Montpelier, Ohio. In form the vault partakes generally of the shape of a burial-casket, being designed in practice to receive a casket. The main section and cover of the vault in this improvement may be of sheet-steel or other suitable material, and in forming the same the parts may be riveted, welded or otherwise secured together, and the inventor may in practice finish the sections by enameling or coating with aluminium or other metals or otherwise. The cover has no lateral projections at its sides to serve as handles, so that it is practically impossible to remove the cover when once applied without great trouble, so that the vault is in a large measure burglar-proof. Other means are provided to prevent the removal of the cover.

ROPE-SOCKET.—T. CANFIELD, Pottsville, Pa. The invention is an improvement in that class of rope-sockets which are provided with jaws adapted to embrace and hold the end of a rope. The object is to provide a socket which shall be distinguished by lightness, strength, and security of hold upon a rope, and which may be easily applied to and detached from a rope end and any suspending device.

PIANO.—H. J. WEILER, Indianapolis, Ind. This piano is of that class in which the frame is composed of an iron back and an iron front plate, between which the sounding-board is secured. The maintaining of the proper tension and pitch of the strings after the piano has once been tuned depends largely on the stability of the pin-block, and in the present case the pin-block is supported on a horizontal flange on the front plate which prevents it from having the slightest movement under the tensile strain. While this result is attained, a full, rich and prolonged tone is secured.

AERONAUTIC APPARATUS.—G. MCMULLEN, 77 Barrack street, Perth, Western Australia, Australia. This invention essentially consists in the peculiar mechanical movement employed for the operation of the wings and which movement is of a combined oscillatory and rotary nature. This movement consists in the wing being fulcrumed upon a fixed pivot, while by means of a slot formed in the side frame of the wing the latter is allowed to move or slide on and along such pivot. The wing also rotates on such fixed pivot, with the result that the wing during rotation is in everchanging position to and in respect of such pivot, and consequently the wing performs a variable stroke and moves at altered velocities of beat during its rotation.

BEVEL-RULE.—H. W. YOUNG, Columbia, Canada. Mr. Young's invention relates to bevel-rules, and can be applied to various uses besides measurements and determinations necessary for mechanics to make which may be readily and conveniently secured without special computation. One form of the improvement is more particularly adapted for the use of draftsmen and engineers. If the rule is to be used for the metric system throughout or for any other standard of measure, it is only necessary to provide the proper scales upon the stock and blade and divide the indicating member in accordance with these.

ICE-CREEPER.—P. WENZ, New York, N. Y. The creeper may be quickly and conveniently applied to a shoe at the welt. The construction is such that various spurs extend downward and outward from the outer lower portion of the body of the creeper, enabling the wearer to walk over a carpeted or polished surface without interfering with such surface, and when traveling over an icy surface by simply canting the foot outward the spurs will penetrate sufficiently to prevent the wearer from slipping.

MUSIC-LEAF TURNER.—F. J. WARD, Fitchburg, Mass. By this device leaves of sheet music may be successively turned, and it comprises peculiar levers having fingers adapted to engage the music-leaves and coacting with dogs of a special construction, these dogs restraining the levers when the device is set, and by operating the dogs the levers may be released and under the action of springs provided for this purpose caused to move in such a manner as to turn the leaves.

DISPLAY-TRAY.—J. H. SMITH, New York, N. Y. The object of the inventor is to provide a tray for containing and neatly displaying underwear, hosiery, and like articles, and also supporting tickets indicating the names, prices and other legends pertaining to the goods, the tickets being removably held on the tray to allow of replacing the tickets by others when changing the articles to be displayed.

ALBUM.—J. B. KING, Salt Lake City, Utah. One of the several purposes of the invention is to provide a novel construction of album for use as a stamp, photographic, or scenic album—a calendar or an album wherein anything in the nature of a picture, character, or figure may be placed by printing or mounting upon a tape material to be displayed.

Heating and Lighting.

WATER-HEATER.—G. R. BURT, Perry, N. Y. The present invention has for its object the provision of a new and improved heater for heating water on a gas, gasolene, or oil stove which is simple and durable in construction, easily attached to the stove, and arranged to insure a quick and safe heating of the water. It can be cheaply manufactured and readily applied to stoves now in use.

Household Utilities.

SHADE AND CURTAIN FIXTURE.—J. M. OLIVER, Frankfort, Ind. Mr. Oliver's invention pertains to an improvement in that class of shade and curtain fixtures in which a hanger is used to readily place the ordinary window-shades and lace curtains or drapery to a window-casing of any width and one whereby the same articles may be readily removed and replaced without recourse to the ordinary brackets permanently secured to window-frames.

DOMESTIC UTENSIL FOR COOLING LIQUIDS.—J. H. DOYLE, New Orleans, La. In the present patent the improvement has reference to domestic utensils for cooling liquids. It has for its object to provide a cover for domestic utensils having a hollow cooling attachment projecting therefrom into the utensil and adapted to have water forced therethrough for the purpose of cooling the contents of the utensil.

Machines and Mechanical Devices.

COMPUTING-MACHINE.—G. O. GILBERT, Montrose, Col. In this case the invention has reference to computing-machines, an object being to provide a machine of this character that will be simple in construction and inexpensive and by means of which long columns of figures may be quickly and accurately added, the machine being also adapted for subtracting.

TRANSMISSION-GEAR.—E. J. SWEDLUND, Atwater, Minn. The invention relates to transmission-gears suitable for general use and particularly in connection with automobiles and other vehicles and with machinery in which power is to be transmitted from one shaft to another. All the movements are relative and the invention may be employed in a diversity of relations wherein motions are to be translated from one point to another.

GIN-FEEDER.—E. R. BARBER, Valdosta, Ga. The apparatus involves a hopper the bottom of which is formed of a traveling carrier which moves the cotton continuously at one end. At said end is a peculiarly-constructed gripping and conveying device which takes the cotton from the hopper and carries it to the gin, the superfluous cotton being removed from the gripping and conveying device by a rocker which works above the same. It is adapted for use in connection with any gin—for example, those shown in three former patents granted to Mr. Barber.

GRINDING AND SCOURING MACHINE.—L. SCHULTE, New York, N. Y. In this instance the object is to provide a new and improved machine for grinding, scouring, scratch-brushing, buffing, and sand-buffing sheet metal, band-iron, wire, and like metal articles and arranged to simultaneously treat both faces of the article in a comparatively short time without requiring skilled labor.

TABLET OR PILL COUNTING MACHINE.—C. A. OHLENDORF and W. BROUGH, Baltimore, Md. The leading feature of the machine is a hollow rotatable cylinder having one or more peripheral openings from which the pills or tablets are discharged as the cylinder rotates and provided with a corresponding number of interior grooves forming guideways by which the pills or tablets are assembled in rows and directed to the discharge openings with due regularity.

CUTTING APPARATUS.—A. J. CONNELL, New York, N. Y. In this patent the invention has reference to cutting apparatus and more especially to that adapted for wood-working. Its principal objects are to furnish convenient power-driven mechanism of a portable character in which the relation of the cutters to the work may be readily adjusted.

The apparatus will be useful in many connections where work has been erected and it is desired to further operate upon it.

Medical Appliances.

STERILIZER.—H. W. C. THOMAS, Valatie, N. Y. This inventor's improvement relates to apparatus for sterilizing various articles, and more particularly such instruments or tools as are used by surgeons, dentists, and barbers. The principal objects are to provide a convenient apparatus in which a circulation of the sterilizing fluid may be secured by the introduction and the withdrawal of the instruments.

HYPODERMIC SYRINGE.—J. DE LISLE, New York, N. Y. This syringe is more especially designed for making hypodermic injections of antitoxic serum and arranged to maintain its parts during the time the implement is stored or in transit in an absolutely aseptic condition, to prevent contamination of the serum, and to insure free unobstructed flow of the serum through the needle when the syringe is used.

DENTAL SEPARATOR AND TOOTH-HOLDER.—E. D. BARNES, Enfield, N. C. This instrument invented by Dr. Barnes is to be used by dentists for getting space between the natural teeth for facilitating access to cavities between the teeth when filling the same and to give access for polishing or making examinations and which device is also designed to be so held upon the teeth as to prevent the separator-claws from pressing on the gums and which device also serves as a prop between the upper and lower teeth to hold the mouth open.

TRUSS.—F. KING, New York, N. Y. One purpose of this invention is to provide a device that effectually prevents the scrotum escaping backward when the attitude of the wearer is changed, as in athletic exercises, the mounting of a horse, etc. Another is to provide a waist-belt and straps to prevent the apron from slipping upward or downward, and the waistband is provided with an attached broad stiffened pad at the rear, which engages with the small of the back, renders the waistband comfortable in use, and sustains the muscles at such point.

Prime Movers and Their Accessories.

ROTARY VALVE.—T. G. VAN SANT, Paragould, Ark. This invention relates to a valve mechanism for steam and other elastic-fluid engines; and resides particularly in an improved rotary valve, by means of which steam may be admitted to and exhausted from the engine-cylinder. It is especially intended for use with the rotary cut-off forming the subject of Mr. Van Sant's former patent, of the application on which said patent issued his present application is a division.

CARBURETER FOR HYDROCARBON-ENGINES.—N. LEINAU, Ashbourne, Pa. The most prominent feature in this case resides in a peculiarly-arranged mobile member driven by the air-current through the carbureter and connected with a means for forcing the liquid fuel into the air-passage of the carbureter, where by aid of the mobile member it is thoroughly commingled with the air on its way to the engine or other apparatus in connection with which the carbureter may be used. This member is in form of a fan rotated by the air currents and having connection with a pump placed in the fuel passage and acting to force the liquid fuel through the discharge-nozzle into the air-passage in close association with the fan.

VALVE-GEAR FOR ENGINES.—J. L. WHEELER, San Francisco, Cal. Mr. Wheeler's invention relates to improvements in devices for automatically cutting off the steam supplied to engines, particularly engines employed for heavy work, such as in sawmills. In sawmill work fuel is not a consideration, and in such cases the slide valve of the engine should be set to cut off at the lowest part of the stroke, which will enable it to run all machinery except "circulars" and "band saws," and the cut-off attachment may be adjusted so as to give the valve full travel when the log comes to the saw.

Pertaining to Vehicles.

UNICYCLE.—C. G. CROSSE, Sun Prairie, Wis. In this device the pedal is pressed by the foot, which depresses one side of a bar and pulls down the cranks. This gives corresponding oscillatory motion to two rods which in turn operate two others, one of the latter operating a member which represents the human foot. This simulates the motion of the human leg and foot and exerts a pushing force in a forward direction, thus urging the wheel forward. When one pedal is depressed the other is elevated, thus giving the reverse movements to the parts, and by operating the opposite pedal the same action takes place with respect to the leg on the opposite side.

OIL OR GASOLENE ATTACHMENT FOR GAS-ENGINES.—J. E. GREEN, Belmont, W. Va. One aim of the inventor is to provide an attachment for a gas-engine to allow of running the engine with gas from an oil-well or with gasolene in case the gas-supply gives out, or in case the supply is low and not sufficient to run the engine then oil or gasolene-vapor is supplied through the attachment in any degree to form an explosive mixture with the gas, the arrangement being such that the necessary changes can be made while the engine is running.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7003.—For manufacturers of furnishing fixtures for a toy shop.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7004.—For manufacturers of peroxide of iron, venetian red, corcus mortis, powdered pipe clay, chalk, oxalic acid.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7005.—Wanted, address of firms who underwrite stocks and bonds.

2d-hand machinery. Walsh's Sons & Co., Newark, N.J.

Inquiry No. 7006.—For the names of firms that make perfectly puncture-proof bicycle tires.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 7007.—For manufacturers of machinery used in making bricks.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 7008.—For manufacturers of plants for distilling turpentine, wood alcohol, creosote, etc., from rich pine stumps.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7009.—For manufacturers of the "Peerless Combination Sharpener."

I sell patents. To buy them on anything, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7010.—For manufacturer of an article called "Flat Lap."

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7011.—For machinery for making drop chalk and precipitated chalk.

Gut strings for Lawn Tennis, Musical Instruments, and other purposes made by P. F. Turner, 46th Street and Packers Avenue, Chicago, Ill.

Inquiry No. 7012.—For manufacturers of perforated patterns for stamping linen, leather, wood and plush.

For sale or exchange for well-boring outfits patent No. 583,760. Riveting mandrel for riveting well casing and other work. For more information or particulars address J. F. Mantey, Patterson, Texas.

Inquiry No. 7013.—For manufacturers of china and glassware.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, wood fiber machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 7014.—For manufacturers machinery for making soft drinks.

Space with power, heat, light and machinery, if desired, in a large New England manufacturing concern, having more room than is necessary for their business. Address Box No. 407, Providence, R. I.

Inquiry No. 7015.—Wanted, party to make woven wire rat traps.

Absolute privacy for inventors and experimenting. A well-equipped private laboratory can be rented on moderate terms from the Electrical Testing Laboratories, 548 East 80th St., New York. Write to-day.

Inquiry No. 7016.—For inventors and manufacturers of safety explosives.

Advertiser, having ample facilities for manufacturing, desires to meet party who thoroughly understands the manufacture of small dynamos, motors and electric fans, who is already engaged in or desires to enter into manufacturing. Address Dynamos, 794 Broad Street, Newark, N. J.

Inquiry No. 7017.—For manufacturers of cement poles.

WANTED.—Formula of a composition with which to cover the caulked decks of pontoons. It must set hard and tough, so that handling a cargo will not break, crack or indent it, adhesive and elastic so as to stick to wood and yet give to heat and cold, and homogeneous and waterproof so as to keep all liquids out all over. Shanghai & Hongkew Wharf Company, Limited, Shanghai, China.

Inquiry No. 7018.—For manufacturers of the latest, up-to-date smoking tobacco machinery.

A GOOD LOVE STORY.

"A Paper Proposal" is the title of a clever piece of fiction contained in "Mountain and Lake Resorts," a book just issued by the LACKAWANNA RAILROAD, in which some of the most delightful summer resorts in the east are illustrated and described. The story is well worth reading, and the other information may help you in selecting your vacation place.

The book will be mailed on receipt of ten cents in stamps addressed to T. W. LEE, General Passenger Agent, New York City.

Inquiry No. 7019.—For manufacturers of Sparklet bottles and capsules for making soda water.

Sheet metal, any kind, cut, formed any shape. Die-making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 7020.—For manufacturers of machinery for making kerosene lamp burners.

Inquiry No. 7021.—For manufacturers of milling machines.

Inquiry No. 7022.—For manufacturers of luminous paint.

Inquiry No. 7023.—For manufacturers of refrigerating machinery.

Inquiry No. 7024.—For manufacturers of machinery to bend steel plates of 3/8 inch thickness, and also to cut such plates.

Inquiry No. 7025.—For manufacturers of apparatus for drying blood and egg albumen.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9671) E. L. M. asks: 1. Does hammering of iron increase or decrease its strength? For example: Suppose a rod of round iron 5/8 inch in diameter were swelled by hammering to 3/4 inch in diameter; would it be as strong as originally? Suppose this rod is then turned on a lathe back to the original 5/8 inch in diameter; would it be as strong as the original rod? A. As a general rule, hammering iron in the right way and at the right temperature, improves its quality and increases its strength. But upsetting a 5/8-inch rod until it was 3/4 of an inch in diameter in the way an ordinary blacksmith would be likely to do it would probably injure the material, and it would be weaker after than it was before the operation was performed. It, however, would be perfectly possible to conduct this operation in such a way that it would be stronger, but it would have to be very carefully and skillfully done. Metal cannot be abused without injury to it. 2. Has there been invented a process for treating tool steel so that if worked at the right temperature it will temper itself on cooling? A. Some of the so-called hardening steels will do what you suggest. Mild steel may be case-hardened in the same way that you would case-harden wrought iron. You may also weld a thin piece of high-carbon steel to the end of your rods.

(9672) E. Z. says: Kindly let me know what the water pressure in an ordinary household faucet is, if you possibly can tell. A. The water pressure at the faucet in an ordinary house varies with the location of the house. A house on a hill or at a distance from the standpipe or pumping station will have less water pressure than one situated lower down or near the standpipe or pumping station. A general average might be taken as somewhere between 25 and 70 pounds per square inch, depending on the city and the location as above noted; but in some instances it will be outside of the limits above mentioned.

(9673) F. H. writes: For a red varnish to be used on electrical articles, allow me to submit the following recipe: Melt together 2 parts of Venetian turpentine (Terebinth Venet.) and 1 part pale shellac (orange shellac will do as well); when temperature reaches 60 deg. C. add 10 parts alcohol. Rub up 3 parts pulverized cinnabar (vermilion) with sufficient alcohol to form a paste, and add to the melted mixture. The operations should be carried on in a water bath, to avoid undue heating. Stir until a smooth liquid is obtained. This should be allowed to cool, continually stirring, and when required should be heated over water bath until it can be applied with a brush. Articles to be coated should be warmed. This paint dries somewhat slowly, but gives beautiful rich permanent color. Needless to say, the necessary precautions as regards fire have to be taken when preparing the paint, as same is inflammable.

(9674) E. R. says: In that sort of mirage termed looming, does not one see the object by direct ray, and not by reflection? Do you not really see an object (ordinarily obstructed from view) just as much as though there was no obstruction intervening? A. The looming of an object is supposed to be produced when the upper air is warmer than the lower air, so that the rays are totally reflected above the eye and come down to the eye. Thus the object is seen above its own real position. Since the light has been reflected, the thing seen is an image as really as in any other case of reflection by a mirror.

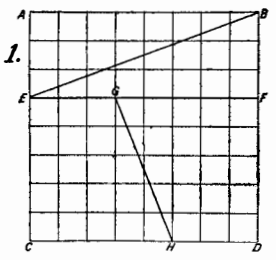
(9675) F. M. asks: Please explain to me the method of lining up a simple engine and oblige a reader of your paper. A. The best way to line up a simple engine is to stretch very tight a fine piano wire through the exact center of the cylinder of the engine, and make all measurements from this. Another wire may be stretched at right angles to it, parallel with the shaft. This right angle can be determined by a large machinist's square or by an engineer's transit. The cylinder and guides can be lined up directly from the first wire, and the bearings for the main shaft can be adjusted until they are parallel with the second wire.

(9676) W. K. asks: 1. What action (chemical) does zinc chloride furnish in a dry cell? Sal-ammoniac? Does manganese furnish any action besides its depolarizing effect? A. The zinc chloride does not exert any chemical action in a dry cell directly; that is, the action of the zinc and ammoniac chloride (sal-ammoniac) is to form zinc chloride. The zinc salts put into a dry cell serve principally to keep the paste porous and moist, since these have a strong affinity for water. Manganese dioxide serves simply as a depolarizer in a dry cell, as it does in a wet cell. 2. Does high initial amperage increase life of a battery, or does it mean that it will be short-lived? A. The amperes of a cell depend upon the external resistance, and there is no propriety in giving amperes, unless it is stated also against what resistance the amperes are flowing. If a large number of amperes are drawn from a cell at first, the cell will be shorter lived than if a low amperage is drawn. A cell will have a certain number of ampere-hours of life. If 100 ampere-hours, the cell will last approximately 100 hours if 1 ampere is the rate of current, but only 10 hours if 10 amperes be drawn. This law is as true of dry as of wet cells. 3. What do you consider best type of wet and dry cells on market to-day for telephone service? A. We have no judgment to give as to the best dry or wet cell. We presume there is no cell which deserves such a distinction. There are many reliable houses offering cells. We presume your local dealers are reliable, and that you are safe in taking their advice. We do not advertise in Notes and Queries. Our advertising columns may be consulted, and we think our advertisers are unusually reliable. We doubt if there is any such thing as a superlatively best thing of any kind. We are not willing to say that there is. 4 In gas and gasoline engines, what affects the life or service of the batteries? A. There is nothing very peculiar in the service a battery performs on a gas engine, except the regularity of its action. It wears out as any other battery does by the work it does, and rather sooner because of the constancy with which it is called upon for current. It is a popular impression that a battery should last indefinitely, but really it is like any other source of power. It can only give back the power which is given to it, and when that is done the battery stops work. No one is ever ready to have the battery stop. Few understand that a battery uses up materials as an engine uses up coal. So much zinc and chemicals, so much electricity. It is a simple matter.

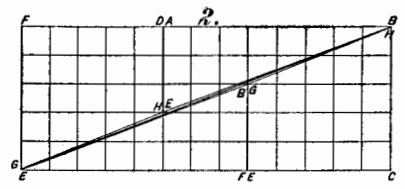
(9677) G. F. says: 1. Is there any sound when there is no ear to hear it? For instance, if a tree were to fall and there were no living thing within hearing, would there be any sound? Please explain fully. A. There may be *sound* when there is no ear to hear it, and the fall of a tree would produce exactly the same noise, whether or not there be any one near at hand. What we call "sound" consists in reality of pulsations or wave vibrations in the air or whatever medium the sound traverses. If a stone fell into a smooth body of water, it would produce waves on the surface of the water, whether or not there be any person present to see them. In the same way, it would produce waves or pulsations of sound in the air. 2. Give a rule for figuring the drawbar pull of a traction engine. As an example, figure the pull of the following engine: Cylinder, 10 x 10¼; 225 revolutions, cutting off at two-thirds stroke; pressure, 120 pounds; traction wheels, 64 inches diameter, geared 1 to 17. A. The engine which you describe ought to be able to produce a drawbar pull of from ten to fifteen thousand pounds for each cylinder, provided the driving wheels do not slip. If this force is more than eight or ten per cent of the weight on the driving wheels, they are likely to slip.

(9678) G. L. P. writes: In the June 10 issue of the SCIENTIFIC AMERICAN, in Notes and Queries, No. 9656, H. J. F. asks if a piece of paper 8 by 8 inches square can be cut so as to make 65 square inches. You say: "No, by no conceivable means." Now you will find inclosed a piece of paper 8 by 8 inches, which you are to cut on the lines and put together as lines shown on the smaller piece, and then measure. I think you will find it to be 5 by 13 inches, which equals 65 square inches. I am unable to explain where the square inch comes from, but it is there. A. No, friend, it is not there. We exceedingly regret that any of our correspondents should think us capable of believing that a square of eight inches on a side can be cut into pieces and put together in another way so that its area shall be increased 1 square inch. We are having a deluge of letters on this point, of which we print one, many criticising us more or less severely for saying that this cannot be done. But of course it cannot be done. We repeat it—No, by no conceivable means. It transcends common sense to ask it. Try it with pennies, or kernels of corn, or any convenient similar pieces. Lay out 64 in a square of eight on a side. Then change them to a figure of 5 rows of 13 on a side. There will be a missing kernel or coin. You cannot complete the second figure. It is the same if you cut a piece of paper of the same dimensions; 8 x 8 cannot be anything but 64, and can never be 65. Why not settle one's self first upon simple foundations? Then one will not say, as our confident correspondent does, "But it is there." That begs the question. It is not there, and cannot be there. There is evidently a fallacy here somewhere. Now, this is no new trick.

It has been traveling around for an unknown period of time, and has been shown up as often as it appears. The SCIENTIFIC AMERICAN had it a generation ago. Still, apparently, there are a host of intelligent people who have never seen the exposure. Hence we will give it, not following the usual mode of treatment, but giving our own explanation of the falsity of the proposition. This is not a puzzle, for a puzzle should have a rational solution, and this thing has no such solution. It is a trick, to make the false seem true. The proper attitude of mind toward it is to seek for the reason of its falsity, since it cannot be true. Only one of our correspondents even suggests that it cannot be true. When you see a juggler perform an impossible thing, such as cutting a man's head off, pulling a great quantity of dry goods out of a hat, or doing the curious box trick, you do not immediately demand that all these shall be accepted as realities; on the contrary you seek the method of the deception. That is the right attitude of mind toward a physical impossibility, and is applicable here. Perhaps the easiest way to show the falsity of the question under discussion, is to draw a figure 5x13, divide it into squares and draw a diagonal line across the figure as in Fig. 2.



Our Fig. 1 shows the square of 8 inches divided for the purpose of the puzzle. Draw the perpendiculars as shown and the points *HE* and *BG* do not fall at the corners of squares. They cannot. Yet the so-called solution which all our correspondents send us, shows the same thing—that the lines *EG, BF, AE, BF,* which should be 3 inches long, are more than 3 inches long. In every figure



this is so. You should be sharper than to draw a figure like that and send it to us if you are to convict us of error. There is an error, but *you* are in error. The diagonal of your long figure, 5 x 13, must be a straight line, if you are correct, but the four pieces of paper when put together do not give a long straight diagonal, as any one can see who will put the pieces together, then use his eyes and look for himself. If your eyes will not show it to you, take a straight ruler and it will disclose the truth for you. The long, sloping line of the pieces of paper is not straight. The four pieces of paper do not cover the area which they seem to cover. There is a long, narrow strip in the center which is not covered. The area of this strip is just one square inch, the square inch which you careless ones think you gain. If you do not make money with any more reality than you gain area of paper in this trick you will never be rich. You put your rulers on and draw a long straight line sweeping from one corner of the 5 x 13 figure quite across to the other corner, and say "There it is, I have made 64 square inches into 65 square inches." Great act! But you have not. Now turn to the square of 8 inches on a side, our Fig. 1. The line *BE* slopes 3 inches in 8, or ⅜ of an inch in 1 inch. The line *GH* slopes 2 inches in 5 inches, or 2-5 of an inch in 1 inch. And you ask us to believe that a line whose slope is ⅜ should form a straight line with one whose slope is 2-5. We cannot do it. The reason anyone is deceived is that the pieces are rarely cut with a high degree of accuracy. They are often cut out of thin paper, and will not lie flat. When they are put together they seem to cover the space as well as could be expected and so the deception takes effect. If the trick were approached from the other side, that is, cut the pieces from the piece which is 5 x 13, and put upon a square carefully drawn to be 8 x 8, the pieces would then more than cover the square figure and deception would not be so easy.

(9679) B. B. asks: Which part of a wagon wheel, when traveling on the road, goes the fastest, the top or the bottom? A. All parts of a wagon wheel go along the road with the same speed, the same as the horse moves. So too all parts of the wheel turn around the axle with the same angular speed, that is, every point which is at the same distance from the center moves with the same speed, but each point moves with a speed which is proportional to its distance from the center of the axle. The center line of the wheel does not rotate at all. There are other motions of the parts of a wheel which are discussed in Queries 9622 and 9635; also in the correspondence column of Vol. 92, No. 25, to which we would refer you. We can send you these numbers for thirty cents.

NEW BOOKS, ETC.

SPANISH-ENGLISH DICTIONARY OF MINING TERMS. By Frederick Lucas. London: The Technological Institute, 1904. 12mo.; pp. 78. Price, $2.

This little dictionary will be found a handy companion by all mining men operating in South America. It has been compiled by a well-known technical translator of London—a man who has had a great deal of experience in translating mining literature—and it will be found very complete and serviceable as a handy pocket dictionary of mining terms.

NATURE STUDY WITH COMMON THINGS. By M. H. Carter. New York: American Book Company, 1904. 12mo.; pp. 150. Price, 60 cents.

This book, by an instructor in the Department of Elementary Science of the New York Training School for Teachers, is intended to serve as an elementary laboratory manual and guide for young pupils, the object being to introduce them to, and give them practice in, the method of procedure in laboratory investigations. All the principal fruits and vegetables are illustrated as a whole and in section, and a lesson is devoted to each. These lessons are suitable for children of from four to six years of age. It is believed that they will successfully solve the problem of an adequate training in elementary laboratory methods. Only the simplest apparatus is necessary in pursuing this laboratory course.

THE EYE, MIND, ENERGY, AND MATTER. By Chalmers Prentice, M.D. Chicago: Published by the Author. 1905. 12mo.; pp. 131. Price, $1.50.

Our author regards the human body as a power-house, and disease as perverted function due to too much or too little energy. He gives five good reasons why the eyes are, of all organs of the body, most capable of making an excessive draft on the general fund of nerve-energy. Hence, in scientifically resting the eyes, using "repression" or strain-reserving glasses, we may often conserve energy and re-establish natural functioning. Other interesting theories are advanced, and strong evidence adduced in their support.

AMERICAN TELEPHONE PRACTICE. By Kempster B. Miller. New York: McGraw Publishing Company, 1905. 4vo.; pp. 888. Price, $4.

The fourth edition of this standard work has been greatly enlarged and brought up to date, so that it now covers the telephone practice of to-day completely and accurately. Obsolete methods and equipment are not described, except where they are of exceptional educational or historic value. Complete information is now given regarding the common battery or central energy system, and such objects as trunking between common battery offices, private branch exchange service, measured service, toll switchboard systems, and power plants are here described in detail. Besides numerous cuts of telephone apparatus, the book contains a considerable number of diagrams of complicated circuits, which are more complete than those usually found in such books. As a guide to the student of practical telephony whose experience has been insufficient to make him conversant with all branches of the subject, and also as a reference book for the experienced telephone engineer and operator, this volume will be found invaluable.

ELEMENTS OF MECHANICS. Forty Lessons for Beginners in Engineering. By Mansfield Merriman. New York: John Wiley & Sons, 1905. 12mo.; pp. 172. Price, $1.

Though great advances have been made in the methods of instruction in all branches of applied mechanics during the past forty years, little change has taken place in the manner of presenting the subject of rational mechanics. The field is so great that but a part of it can be introduced in one volume, and the object of this elementary volume is to apply the best methods of applied mechanics to the development of the fundamental principles and methods of rational mechanics. The limited course usually given in engineering colleges is so difficult, and appeals so little to the student's experience, that few fully master it. This book presents the fundamental elements without employing advanced mathematics, the knowledge of plane geometry, elementary algebra, and plane trigonometry only being necessary to read the work with interest and profit. Numerous numerical illustrations are given, queries and problems are stated as exercises for the student, and a system of units is employed with which every boy is acquainted.

SUCCESSFUL FRUIT CULTURE. By Samuel T. Maynard, B.Sc. New York: Orange Judd Company, 1905. 12mo.; pp. 274. Price, $1.

This book forms a practical guide for anyone engaged in the cultivation and propagation of fruits. It contains a summary of the scientific progress made in fruit culture up to the present time, together with the practice of the most successful fruit growers throughout the country. This information is expressed in condensed form and simple language, so that the book is especially of value to a person starting in the business of fruit growing, or to the dweller in the country who wishes to grow a small quantity of fruit for family consumption. The book covers the entire practice of fruit growing, from the starting of the seed to the cutting and marketing of the fruit. The author endeavors to show how to grow the best possible fruit at the least cost. All our common fruits and berries are described, and the best manner of growing them is given. The book is illustrated with numerous half-tones reproduced from photographs of orchards and growing trees, as well as by a considerable number of diagrams interspersed throughout the text.

FERRIC AND HELIOGRAPHIC PROCESSES. By George E. Brown, F.I.C. New York: Tennant & Ward, 1905. 12mo.; pp. 149. Price, $1.

The second edition of this work, which has just been issued, contains much information of value especially to draftsmen, engineers, architects, and others who find the reproduction of tracings and drawings an everyday necessity. The book will also be found interesting by amateur photographers who have a taste for experimenting. The processes described are all simple and practical. Among there are the ferro-prussiate, the kallitype, the obernetter, and the uranotype processes. The various heliographic processes are compared in Chapter IX., and other chapters are devoted to the "Preparation of Heliographic Papers" and "An Outfit for Heliographic Printing." Several minor heliographic processes are described, as well as the pellet, or blue line on white ground; the ferro-gallic, or black line on white ground; and the brown line on white ground processes. The chapter on "Printing on Fabrics and in Dyes" will perhaps be found most interesting to the amateur photographer. The book also has useful chapters on Manipulation; Paper and Sizing; Chemicals; and Chemistry.

SCIENCE AND HYPOTHESIS. By H. Poincaré. London and New York: Walter Scott Publishing Company, 1905. 12mo.; pp. 244. Price, $1.50.

This work by an eminent French scientist has been well translated, and thus made available for English readers. It is divided into four parts, which treat of Number and Magnitude; Space; Force; and Nature. The chapters of Part I. are devoted to Mathematical Magnitude and Experiment, and the Nature of Mathematical Reasoning. Those of Part II. deal largely with Space and Geometry. Energy and Thermo-Dynamics, Relative and Absolute Motion, and the Classical Mechanics, are discussed in Part III.; and, finally, Part IV. deals with the Hypothesis and Theories of Modern Physics, the Calculus of Probabilities, Optics and Electricity, and Electro-Dynamics. This book will be found worth reading by all lovers of pure science.

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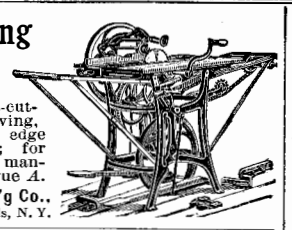

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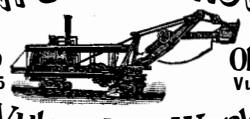

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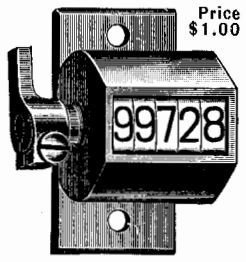

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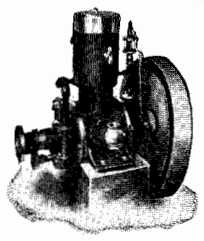

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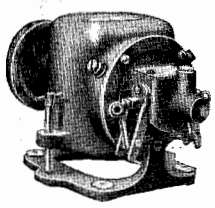

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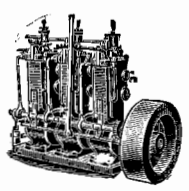

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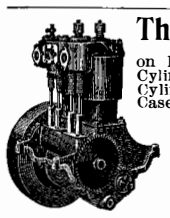

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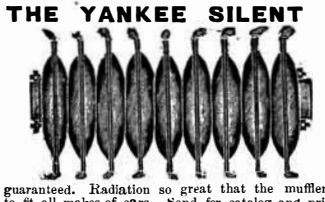

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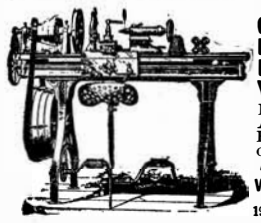

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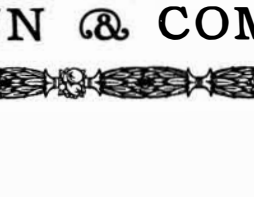

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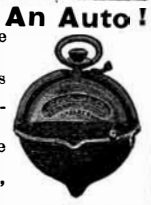

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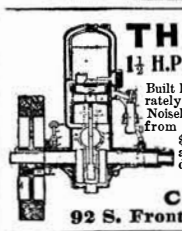

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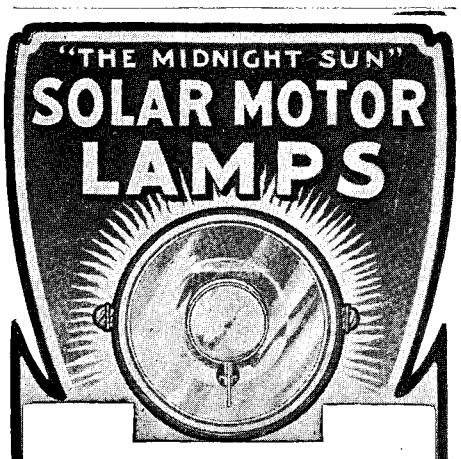

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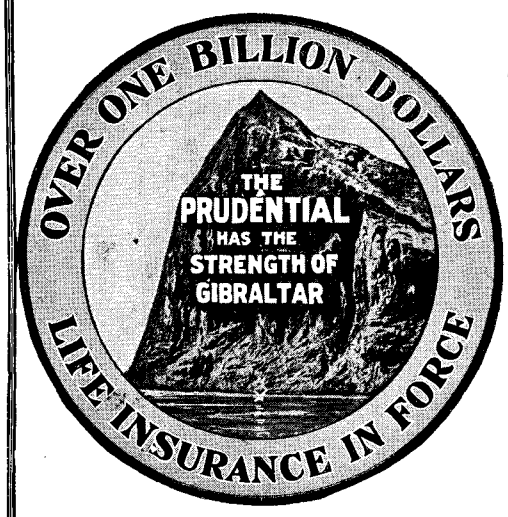

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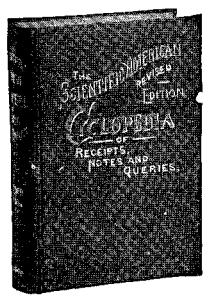

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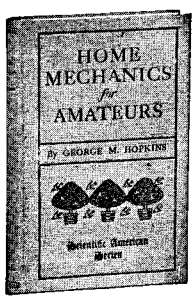

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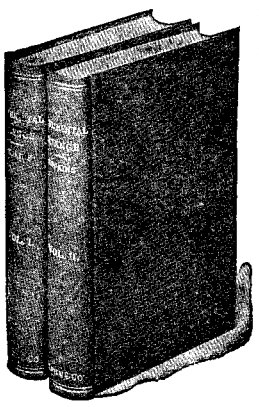

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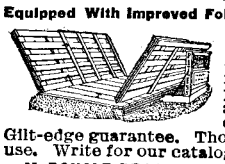

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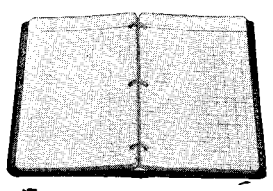

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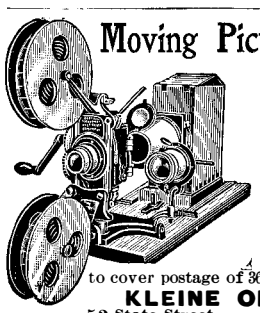

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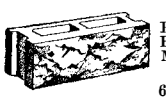

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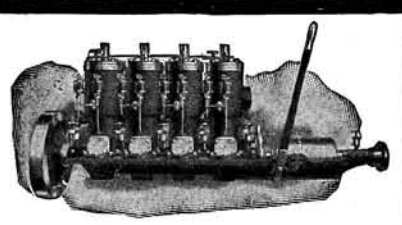

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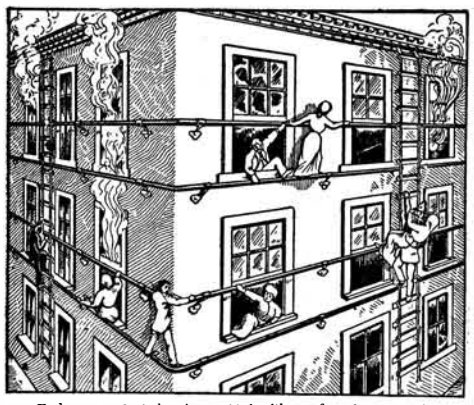

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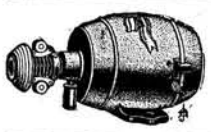

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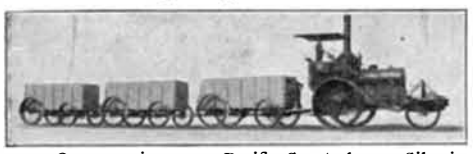

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"Ideal," for canned peas, Pioneer Canning & Pickling Co.	12,220
"London Butter Fudge," for candy, Burgess Mfg. Co.	12,225
"Roberts' Feverine-Tonic," for horse remedy, E. Roberts	12,229
"Sal Tonique," for a medicine, Norwich Pharmacal Co.	12,228
"Sapolin Gold Enamel," for gold enamel, Gerstendorfer Bros.	12,230
"Snow-Flake Confections," for candy, Burgess Mfg. Co.	12,223
"Solfereno," for candy, Burgess Mfg. Co.	12,224
"The Famous High Ball Ginger Ale," for ginger ale, H. R. Melster	12,226

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"Liquid Food for Old and Young," for beer, Geo. Wiedemann Brewing Co.	1,355
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"Peach Blow," for a beverage, Liquid Carbonic Co.	1,356
"Print of Certification, Genuine Thacker Coal," for coal, Thacker Co.	1,361
"20 Millions," for flour, Washburn-Crosby Co.	1,357
"Women's Apparel," for women's apparel, Meyer-Both Co.	1,360

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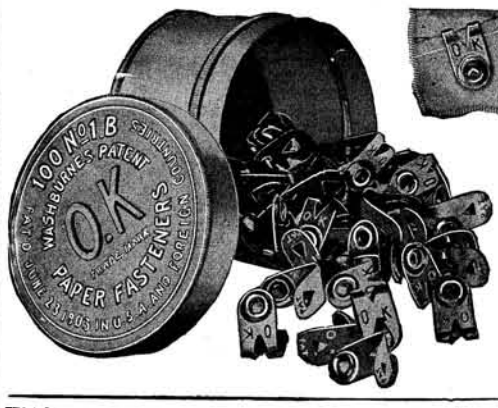

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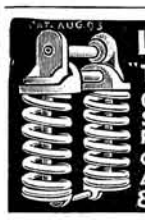

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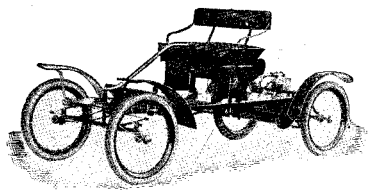

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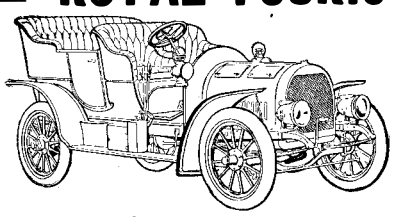

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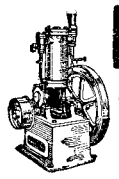

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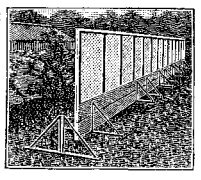

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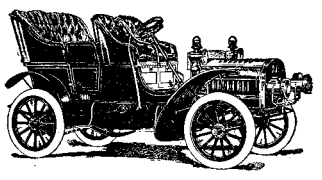

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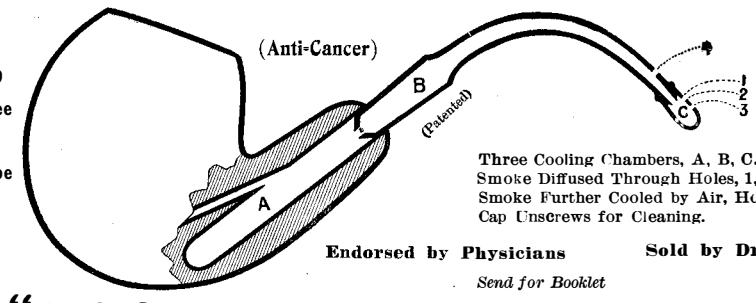

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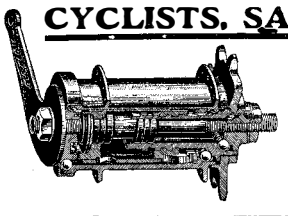

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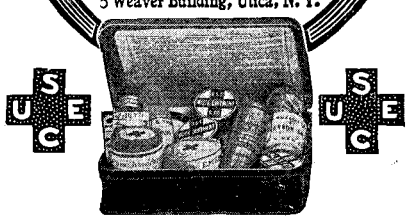

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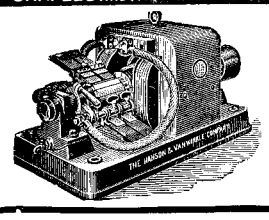

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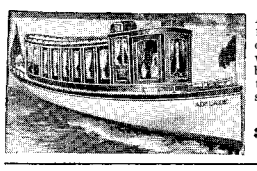

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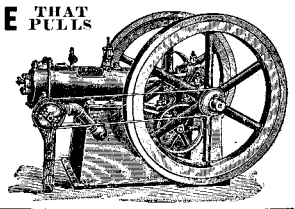

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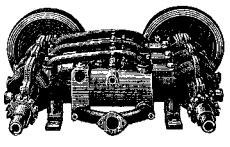

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